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Dietary Intake and Dietary Attitudes Among Food Stamp Participants and Other Low-Income Individuals

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EXECUTIVE SUMMARY

The Food Stamp Program (FSP) is designed to "safeguard the health and well-being of the Nation's population by raising the level of nutrition among low-income households." The program aims to meet this objective by providing food stamp benefits to low-income households that can be used to purchase foods from authorized food retailers. The program also supports nutrition education efforts, by providing funds for states to set up nutrition education programs (NEPs) for FSP participants. As of fiscal year 2000, the FSP had agencies with approved NEPs in 48 states and federal funding for these programs was projected to total $99 million.

In studying the effectiveness of the FSP, a critical research question involves determining the relationship between program participation and dietary outcomes. An unresolved issue in the literature on the effects of the program is the role of dietary knowledge and attitudes. It is not known whether participants and low-income nonparticipants differ in their dietary knowledge and attitudes or whether any such differences influence their dietary intake. Finally, it is not known whether controlling for any such differences would influence the estimated relationship between food stamp participation and dietary outcomes.

This report examines the dietary knowledge and attitudes of low-income individuals, including FSP participants and nonparticipants, describes their dietary intake, and estimates participation-dietary intake relationship. In particular, the analysis addresses three basic questions:

1. What do low-income adults know about healthy eating practices, and how do they feel about these practices and about their own diets?

2. What do low-income Americans eat, and how do their diets stack up against accepted standards for healthy eating?

3. What is the relationship between food stamp participation and dietary intake among low-income individuals and do differences in the dietary knowledge and attitudes among participants and low-income nonparticipants mediate this relationship?

The analysis was based on data from the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII) and the associated Diet and Health Knowledge Survey (DHKS). These nationally representative data sets were used to create an analysis file containing about 4,000 low-income and 10,000 high-income preschoolers, school-age children, and adults. Low-income and high-income individuals were distinguished on the basis of whether their household income was below or above 130 percent of poverty. The high-income sample was included to provide benchmark values for the low-income sample.

Estimates of the relationship between participation and dietary outcomes were based on regression models in which the dependent variables were the dietary outcomes, and the independent variables included food stamp benefits and a wide range of individual and household characteristics. One limitation of the analysis is that, since experimental methods were not used, the estimates of the effects of FSP participation on dietary outcomes may have been biased by unobserved differences between participants and nonparticipants. Previous studies have cited dietary knowledge and attitudes as one possible source of this bias. A major aim of this study is to address this possible methodological weakness by controlling explicitly for the dietary knowledge and attitudes of low-income adults to determine whether this affects the estimated participation-dietary intake relationship. The analysis also controls for differences between the income and health status of participants and nonparticipants, as well as many other factors. However, other unobserved factors that represent the degree to which participants are socially or economically disadvantaged may remain.

DIETARY KNOWLEDGE AND ATTITUDES AMONG LOW-INCOME ADULTS

There is room for improvement in two dimensions of dietary knowledge among low-income adults. Large numbers of low-income adults do not know specific facts related to the health consequences of particular dietary practices, such as what health problems result from eating particular types of foods. Similarly, many low-income adults do not know specific facts related to what types of dietary practices are healthful, such as what specific foods they should eat to maintain a healthy diet. More specifically:

- Among low-income adults, FSP participants and nonparticipants do not differ significantly in their levels of dietary knowledge according to any of the three knowledge indicators that were examined.

- In general, low-income adults have lower dietary knowledge levels than high-income adults. Overall, the high-income group is between 10 and 20 percent more likely than the low-income group to be able to recall specific pieces of dietary information.

- On average, low-income adults can correctly identify just over half of a set of health problems associated with specific dietary practices such as eating too much fat or not enough fiber. More than two-thirds of these adults know the consequences of being overweight, eating too much fat, and eating too much cholesterol, while only 40 percent know that not eating enough fiber is associated with bowel problems, heart problems, and/or cancer.

- On average, low-income adults know less than half of the U.S. Department of Agriculture’s Food Guide Pyramid recommendations for the daily consumption of the five major food groups. They are particularly unlikely to know that they should consume at least six servings of grain products and three servings of vegetables daily.

- Low-income adults know an average of just over half of a set of facts related to the fat or cholesterol content of specific foods. For example, only 30 percent know that cholesterol is found in animal products like meat and dairy products and only 47 percent know that hot dogs contain more fat than ham.

Both low- and high-income adults appear to place great importance on healthy eating. About 60 percent of each group strongly agrees that "what you eat can make a big difference in your chance of getting a disease." Both groups are also likely to place high importance on following specific healthful dietary practices, such as choosing a diet that is low in fat and cholesterol and that contains plenty of fruits and vegetables. Among low-income adults, for example:

- Seventy-two percent feel that it is very important to choose a diet with plenty of fruits and vegetables.
- Sixty-four percent feel that it is very important to choose a diet low in fat.
- Sixty-one percent feel that it is very important to choose a diet low in cholesterol.

These findings suggest that low-income adults' relatively low levels of dietary knowledge, as described above, do not translate into complacency about their diets. These individuals still feel that it is important to follow healthful dietary practices and that such practices influence health outcomes.

Substantial numbers of low-income adults are not confident that their own diets comply with these healthful dietary practices. They are likely to believe either that their diets are too low in a key vitamin or mineral or are too high in total calories or a key macronutrient. In particular:

- FSP participants are more likely than nonparticipants to believe that their diets are too low in key vitamins and minerals and too high in key macronutrients. For example, 47 percent of participants and 31 percent of nonparticipants believe their diets are too low in fiber, while 50 percent of participants and 39 percent of nonparticipants believe their diets are too high in fat.
- Low-income and high-income adults are about equally likely to believe that their diets are too low in key vitamins and minerals, but high-income adults are more likely to believe that their diets are too high in key macronutrients (such as fat).
- Among the low-income group, just over one-third believe their diets are too low in calcium, fiber, and iron, while 25 percent believe their diets are too low in vitamin C.
- Among the low-income group, 43 percent believe their diets are too high in fat, 33 percent believe their diets are too high in sugar and sweets, and 32 percent believe their diets are too high in calories.

The finding that FSP participants are more likely than nonparticipants to lack confidence in the quality of their diets is particularly interesting given that the two groups have similar levels of dietary knowledge and other types of dietary attitudes. This finding has at least three potential explanations. First, participants may lack confidence in the quality of their diets to a greater extent than nonparticipants because of the nutrition education efforts of the FSP. Second, the difference may arise because participants are in poorer health than nonparticipants. For example, Bialostosky and Briefel (2000) found that participants are more likely than nonparticipants to be obese and to smoke cigarettes. Third, the difference may reflect a true difference in participants' and nonparticipants' dietary attitudes.

WHAT LOW-INCOME AMERICANS EAT

The diets of low-income Americans can be examined from a number of perspectives. The analysis in this report examines individuals' dietary habits, the foods they consume, their intake of food energy and vitamins and minerals, and their intake of macronutrients and other dietary components such as fiber and cholesterol.

Many low-income adults do not engage in specific dietary habits intended to lower the fat and cholesterol content of their diets, such as removing fat from the meat they consume, avoiding fat as seasoning, and substituting or replacing high-fat foods with lower-fat alternatives. For example, only:

- Twenty-five percent never put butter or margarine on cooked vegetables.
- Twenty-three percent always use skim or low-fat milk rather than whole milk.
- Seventeen percent always eat low-fat luncheon meats instead of regular luncheon meats.
- Thirteen percent eat meat at a main meal less than once a week.
- Forty-one percent always remove the skin when eating chicken.

Low-income individuals consume less than the Food Guide Pyramid recommendations for the daily consumption of all five major food groups. Typically, about half of the individuals in a particular age group fail to meet the minimum servings recommendation for a given food group. For some foods and some age groups, consumption is especially low.

- Among low-income individuals in three age groups--preschoolers, school-age children, and adults--39 to 51 percent consume fewer than six servings of grain products daily; *the Food Guide Pyramid recommends six to eleven servings.*
- Sixty percent of preschoolers eat fewer than three servings of vegetables daily; *the Food Guide Pyramid recommends three servings for this age*.

- About 70 percent of school-age children and adults consume less than two servings of fruit daily; *the Food Guide Pyramid recommends two to four servings*.

- Approximately 70 percent of adults consume less than two servings of dairy products daily; *the Food Guide Pyramid recommends two to three servings*.

- Seventy percent of preschoolers eat fewer than two servings of meat or meat substitutes daily; *the Food Guide Pyramid recommends two to three servings*.

With low consumption of the five major food groups, low-income individuals consume large amounts of the foods in the pyramid tip (such as fat and added sugar). Among adults, for example, the mean intake of discretionary fat is 53 grams per day, while the mean intake of added sugar is 18 teaspoons per day. The intake of these food items in the pyramid tip is even higher among school-age children.

On average, low-income individuals' mean nutrient intake levels exceed the Recommended Dietary Allowance (RDA) for most vitamins and minerals. However, substantial proportions of low-income individuals are likely to have inadequate usual intakes for a number of micronutrients. Using usual intake below 70 percent of the RDA as the indicator of inadequate intake:

- Preschoolers are most likely to have inadequate intakes of vitamin E, zinc, calcium, and iron.

- School-age children are most likely to have inadequate intakes of calcium, vitamin A, vitamin E, zinc, and magnesium.

- Adults are more likely than children to have inadequate intakes; the nutrients for which large numbers of low-income adults have inadequate intakes are calcium, zinc, vitamin E, magnesium, vitamin A, vitamin B_6, iron, vitamin C, and folate.

- Adults also have low usual food energy intake levels; 79 percent of low-income adults have usual food energy intake levels less than the recommended energy allowance (REA), which is the estimated mean required intake level among adults. Since 50 percent of adults would be below the REA if they all met their required intake level, an estimated 29 percent of adults (79 minus 50) have intakes below their required intake levels.

Among preschoolers, low-income individuals have slightly higher mean intake levels of several vitamins and minerals than high-income individuals. This difference is statistically significant for protein, niacin, folate, and zinc. Among adults, however, the reverse is true. Low-income adults have significantly lower intake levels of 12 of the 14 vitamins and minerals that were examined.

Overall, low-income individuals are unlikely to meet the Dietary Guidelines for the intake of macronutrients such as fat, saturated fat, and carbohydrates, as well as for the intake of other dietary components such as fiber and sodium. Low-income individuals consume too much of their food energy in the form of fat or saturated fat and too little of their food energy in the form of carbohydrates. In particular:

- Few low-income preschoolers meet the *Dietary Guidelines* for fat, saturated fat, and carbohydrates. For example, their mean intake of fat as a percentage of food energy is 34 percent and only 24 percent meet the dietary guideline of limiting their fat intake to no more than 30 percent of food energy. In addition, only 20 percent limit their protein intake to no more than twice the RDA, and a little over half meet the sodium RDA. However, nearly four of five low-income preschoolers meet the dietary guideline of limiting their cholesterol intake.

- Low-income school-age children have levels of fat, saturated fat, carbohydrate, and cholesterol intake in relation to the guidelines that are similar to those of low-income preschoolers. They are much more likely than preschoolers to meet the dietary guideline for protein but are much less likely to meet the sodium dietary guideline. Only 29 percent of low-income school-age children limit their sodium intake to less than 2,400 milligrams.

- Although low-income adults have slightly lower mean fat and saturated fat intakes than children, they remain unlikely to meet the *Dietary Guidelines* for fat and saturated fat intake. For example, only one in three meets the guideline for fat intake. Most low-income adults meet the dietary guideline for protein and cholesterol intake. However, their mean fiber intake is 14 grams, their mean sodium intake is 3,200 grams, and only 19 and 36 percent meet the *Dietary Guidelines* for fiber and sodium intake, respectively.

High-income individuals are much more likely than low-income individuals to meet many of the Dietary Guidelines. Among preschoolers and school-age children, the percentages of high-income individuals meeting the guidelines for fat, saturated fat, carbohydrate, cholesterol, and (among preschoolers only) sodium intake exceed the percentages of low-income individuals meeting these guidelines. For example, the percentages of high-income preschoolers meeting the fat and saturated fat guidelines are 41 and 28 percent, respectively, compared with 24 and 14 percent among low-income preschoolers. Among adults, high-income individuals are more likely than low-income individuals to meet the *Dietary Guidelines* for fiber, cholesterol, and sodium.

HOW FOOD STAMP PROGRAM PARTICIPATION AFFECTS DIETARY INTAKE

There is little evidence that FSP participation is related to low-income individuals' food group choices. After controlling for individual and household characteristics and the dietary knowledge and attitudes of low-income individuals, there are almost no statistically significant differences in their average consumption of various food groups, including grain products, vegetables, fruit, dairy products, meat and meat substitutes, discretionary fat, and added sugar (the exceptions are significant negative relationships between participation and the intake of grains among preschoolers, the intake of vegetables among adults, and the intake of fish among adults). Subject to the caveat that the analysis does not control for unobserved differences that may exist between participants and nonparticipants, it appears that participation does not influence the number of servings of the major food groups consumed by low-income individuals.

Participants and nonparticipants consume similar amounts of vitamins and minerals, on average. Among preschoolers, participation is insignificantly related to mean intakes of all nutrients except iron, for which there is a negative relationship. Among school-age children and adults, participation is insignificantly mean intakes of all nutrients except folate (for school-age children), for which there is a positive relationship.

Participants and nonparticipants are equally likely to have adequate usual nutrient intake levels. There are no significant differences for any of the micronutrients examined in the percentage of participants and nonparticipants whose usual intakes exceed 70 percent of the RDA (the measure of adequacy used in the analysis).

Participation appears to have little influence on low-income individuals' intake of macronutrients and other dietary components. The percentage of participants and nonparticipants meeting the *Dietary Guidelines* is not significantly different, with two exceptions. First, preschoolers who are FSP participants are significantly less likely to meet the dietary guideline for saturated fat. Second, adults who are participants are significantly less likely to meet the dietary guideline for fiber.

Participation is not related to two measures of diet quality examined--the Healthy Eating Index (HEI) and the Diet Quality Index (DQI). For each of the three age groups examined, the relationship between FSP participation and low-income individuals' HEI and DQI scores is statistically insignificant.

Participation does not appear to be related to dietary intake among a set of subgroups examined in the analysis. Most of the estimates of the effect of participation on intake among subgroups defined by age/gender, race/ethnicity, health status, and income level were statistically insignificant. The few estimates of the effect of participation on intake that were statistically significant did not follow any systematic pattern.

WHERE LOW-INCOME AMERICANS OBTAIN THEIR FOOD

Low-income Americans obtain most of the food they consume from food stores. Low-income adults get three-fourths of their food from food stores, with 18 percent coming from restaurants and 8 percent from other sources. School-age children get only two-thirds of their food from stores, with 13 percent coming from restaurants and the rest (20 percent) coming from other sources (largely school breakfasts and lunches). Finally, low-income preschoolers get 82 percent of their food from stores.

Food stamp participation is related to where low-income individuals obtain their food. Among school-age children and adults, participants obtain more of their food from food stores and less from restaurants and other sources than nonparticipants, on average. This relationship holds up even after controlling for individual and family characteristics and other relevant factors. The most likely explanation for the effect of participation on where individuals obtain their food is that food stamps place constraints on where low-income households purchase their food. To legally use their food stamps, participants must purchase certain foods from certified food stores.

RECONCILING THE FINDINGS WITH PREVIOUS LITERATURE

This report set out to estimate the relationship between FSP participation and dietary intake after taking into account all the relevant factors potentially influencing participation. Since previous research had cited individuals' dietary knowledge and attitudes as a potentially important factor not typically taken into account, the analysis in this report advances the literature by controlling for dietary knowledge and attitudes in estimating how food stamp participation is related to dietary intake.

Results of the analysis show that low-income individuals' dietary knowledge and attitudes do not mediate the relationship between FSP participation and dietary intake. Controlling for adults' dietary knowledge and attitudes does not affect the estimated relationship between participation and dietary intake. Regardless of their dietary knowledge and attitudes, food stamp participation is not significantly related to low-income individuals' intake of food energy, vitamins and minerals, macronutrients, or food groups.

The results of this study are consistent with previous literature on the effects of food stamp participation on dietary intake. Most previous studies have found that participation is insignificantly related to the intake of most nutrients. Where significant relationships have been found, they have not consistently and systematically been positive or negative.

However, the results of research (including this study) on the effects of participation on dietary intake appear to be inconsistent with the results of other research showing that food stamp benefits lead to increases in food expenditures among low-income households. Other previous studies have found a positive relationship between a household's food stamp participation and the availability of nutrients in their household. If food stamps lead households to spend more on foods and to have larger amounts of nutrients available in their homes, one might expect that the benefits would also lead to increases in the dietary intake of household members. This study and the previous literature suggest that this is not the case.

Two methodological issues may partially explain this apparent inconsistency. First, the studies of the effects of food stamp participation on food expenditures and nutrient availability use the household as the unit of analysis, while the dietary intake studies use the individual as the unit of analysis. It is not clear how food expenditures or nutrients available in the home are distributed across household members and across individuals who may not be members of the household. Second, the food expenditure and nutrient availability studies are primarily based on data collected during the late 1970s, while a number of the intake studies are based on more recent data. Since the implementation of the FSP has changed over this period, the results of the studies may reflect changes in the effects of FSP participation over time.

If methodological differences between studies do not explain the pattern of results, two other factors may explain the lack of a positive relationship between participation and dietary intake in the face of estimates of positive effects on food expenditures. First, food stamps may lead participating households to purchase some foods that nonparticipating households might obtain for free. For example, participating individuals might purchase the food they eat instead of obtaining it free from a friend, relative, soup kitchen, or food pantry. This possibility is consistent with the finding that, relative to nonparticipants, FSP participants get more of their food from food stores and less from "other sources." In addition, if purchased food is wasted or consumed by nonhousehold members, then an effect of participation on expenditures (and availability) would not necessarily translate into an effect on intake.

A second reason why FSP participation might not lead to a positive effect on nutrient intake may be that participants purchase more expensive forms of the same foods than nonparticipants. For example, with the additional resources available, FSP participants may select brand-name foods rather than generic foods at stores. They may also purchase more convenient ready-to-eat foods rather than basic staples to use as ingredients in foods they prepare themselves.

FUTURE DIRECTIONS FOR POLICY/RESEARCH

Additional research is needed to address several issues raised in this report. Future research should attempt to use a variety of approaches to determine whether selection bias influences estimated program effects. With better data, for example, studies may be able to more precisely control for individuals' economic circumstances than was possible in this study. Additional data may also allow researchers to develop appropriate "identifying variables" that are correlated with participation but not with dietary intake, as part of a strategy to address the selection bias issue econometrically. Future research should also address the question of how FSP benefits influence households' overall expenditures. Most studies of the effects of FSP on food expenditures are based on relatively old data collected at a time in which the FSP had different program rules. Thus, research should examine the current effects of FSP participation on food expenditures and should also estimate the effects of participation on household spending on nonfood goods and services.

The analysis in this report provides circumstantial evidence that there is a role for increasing efforts to provide nutrition education and promotion among participants. The study finds that participants have "moderate" levels of nutrition knowledge--they are aware of some key aspects of the link between nutrition and health and of what constitutes good nutritional practices, but they also are unaware of other key pieces of nutritional information. Assuming that a link exists between nutritional knowledge and dietary intake (an assumption supported in part by empirical evidence based on prior research), then continuing the existing program efforts at promoting nutrition education among participants may lead to an improvement in the nutritional quality of participants' dietary intake. This study, as well as previous research, shows that additional economic resources provided by FSP benefits alone may not substantially change participants' dietary intake. However, these additional resources, which increase participants' food-purchasing power, supported by nutrition education aimed at helping participants make more informed food choices, may provide participants with the tools and strategies to improve their nutritional intake and dietary quality.

I. INTRODUCTION

The Food Stamp Program (FSP) was created to promote health and nutrition among low-income households by giving them resources that would increase their food-purchasing power. As of August 1999, about 18 million individuals were living in households that received food stamp benefits. To assess the role of the FSP in achieving the objective of promoting health and nutrition among low-income households, it is useful to understand the relationship between participation and dietary intake among these households. In particular, what are the nutrition levels of FSP participants and other low-income individuals not receiving food stamps? Does participation in the FSP appear to help participants raise their nutrition levels?

Also relevant to the FSP is the dietary knowledge and attitudes of participants and nonparticipants. Under the FSP, funding is available to states that set up nutrition education programs (NEPs), which have the objective of motivating healthy eating and lifestyle behaviors that are consistent with the most recent dietary advice as reflected in the *Dietary Guidelines for Americans* and the U.S. Department of Agriculture (USDA) *Food Guide Pyramid*. In particular, the following four key messages are central to nutrition education in the FSP: (1) eat a variety of foods, (2) eat more fruits, vegetables, and whole grains, (3) eat lower fat foods more often, and (4) be physically active.

In recent years, there has been a dramatic increase in the number of states operating NEPs. In 1992, seven states operated NEPs, with a total budget of $661,000. By fiscal year 2000, 48 states had approved NEPs, with a preliminary budget of $99 million. One rationale for funding these NEPs is the assumption that there is room for improvement in the dietary knowledge and attitudes of participants, and that such improvements may be another way for the FSP to positively contribute to the nutritional quality of participants' diets. Thus, research is needed on the dietary knowledge and attitudes of participants and low-income nonparticipants--what these individuals know about healthy eating practices and how they feel about these practices and their own diets.

Another rationale for studying low-income individuals' dietary knowledge and attitudes is that this will help us better measure the effects of participation on dietary outcomes. An unresolved issue in the literature on the effects of FSP participation on dietary outcomes is the role of dietary knowledge and attitudes. Few studies have examined the dietary knowledge and attitudes of FSP participants compared with nonparticipants. Several studies have examined the influence of dietary knowledge and attitudes on nutrient intake, but these studies have generally not examined this relationship among FSP participants. These are important issues, since previous research has acknowledged that a failure to control for dietary knowledge and attitudes could potentially lead to selection bias in estimating the influence of FSP participation on nutrient intake (Fraker 1990; Butler and Raymond 1996).

This study examines the effects of FSP participation on dietary intake after taking into account individuals' dietary knowledge and attitudes. Using 1994 to 1996 data from the Continuing Survey of Food Intakes by Individuals (CSFII) and the corresponding Diet and Health Knowledge Survey (DHKS), the relationships between participation and dietary adequacy and quality were estimated, where dietary adequacy/quality were measured using individuals' reported intakes of key nutrients and specific food groups as well as their reported dietary practices. The analysis controlled for such factors as income and dietary knowledge and attitudes, and took into account the design effects arising from the complex sample design of the CSFII. To place the findings on the effects of FSP participation into context, the average dietary intake and dietary knowledge and attitudes of low-income and high-income individuals were measured and compared.

In sum, the analysis addressed three broad questions:

1. ***What are the levels of dietary knowledge and dietary attitudes of low-income individuals?*** For instance, to what extent do individuals know about specific health problems related to particular dietary practices? What is their knowledge of the USDA Food Guide Pyramid recommendations and the nutritional content of specific foods? How do they feel about healthy eating practices and their own diets? Do dietary knowledge and attitudes vary between FSP participants and other low-income individuals, as well as between low-income and high-income individuals?

2. ***To what extent do low-income individuals' diets meet accepted dietary standards?*** Do individuals consume sufficient amounts of food energy and key vitamins and minerals? To what extent do they overconsume particular dietary components? Do these measures of dietary intake vary by age of the individual--for example, among preschoolers, school-age children, and adults? How do these measures of intake compare against those of high-income individuals?

3. ***What is the relationship between FSP participation and dietary intake among low-income individuals and do dietary knowledge and attitudes mediate this relationship?*** For instance, does FSP participation influence the dietary habits, nutrient intake, or the overall quality of people's diets? Do the effects of participation on nutrient intake differ according to where individuals obtain their food or for different subgroups of the low-income population? Do these estimated relationships change after controlling for dietary knowledge and attitudes?

The rest of this chapter presents a brief background of the FSP and a review of previous research on the effects of FSP participation on dietary outcomes. Chapter II discusses the data and methodological approach used in this study. Chapter III describes low-income adults' dietary knowledge and attitudes, and Chapter IV describes the food and nutrient intake of the low-income population. Chapter V presents estimates of the effects of FSP participation on dietary intake, and Chapter VI contains a summary and conclusions.

A. BACKGROUND OF THE FOOD STAMP PROGRAM

The Food Stamp Program was created to permit "low-income households to obtain a nutritious diet through normal channels of trade by increasing food purchasing power for all eligible households who apply for participation" (Food Stamp Act of 1977, Section 2). To raise the level of nutrition among low-income individuals, the FSP awards food stamp coupons to qualified households that can be used to purchase foods from certified food stores. During fiscal year 1998, the FSP served approximately 20 million people per month, at a total annual benefit cost of $16.9 billion (Castner and Anderson 1999).

FSP benefits are issued to the individual's *household*, which is defined as people who live in the same residence and who usually purchase and prepare meals together. Eligibility for food stamps depends on household income and assets. Households without elderly or disabled members must have gross income less than 130 percent of the poverty line, net income less than 100 percent of poverty, and countable assets less than $2,000.[1] Households with elderly or disabled members must have net income less than 100 percent of the poverty line and countable assets less than $3,000.

Households receiving Temporary Assistance for Needy Families (TANF), Supplemental Security Income (SSI), or General Assistance (GA) are categorically eligible for food stamp benefits.[2] Other types of households are categorically ineligible for benefits, including many postsecondary students' households, households with members on strike, and households whose

[1]Net income represents the amount of income households have available to use for food. It includes gross income, minus a standard deduction, an earnings deduction, and deductions for dependent care, medical care, and excess shelter expenses. For households without elderly or disabled members, the net income test is rarely binding. The term *countable assets* includes financial and vehicular assets.

[2]The Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 ended the Aid to Families with Dependent Children (AFDC) program, and replaced it with TANF. PRWORA also changed a number of features of FSP eligibility. In particular, the legislation denies access to the FSP to some legal immigrants. The law also limits the amount of time unemployed able-bodied adults without dependents can receive FSP benefits, unless they live in an area that has requested a waiver for this work requirement due to high unemployment or insufficient jobs.

head voluntarily left a job without cause. Finally, to maintain eligibility, households receiving food stamps must comply with work registration requirements.[3]

Food stamp benefit levels for a household are set to the maximum benefit level for a household of that size, less 30 percent of the household's net income (including most public assistance benefits). The maximum benefit level is based on the cost of the Thrifty Food Plan, which represents USDA's estimate of how much it costs to provide a household of a given size with nutritious but inexpensive foods. Benefits for households of a given size and net income are the same for all states, except for cost-of-living adjustments in Alaska and Hawaii.

B. PREVIOUS RESEARCH

The three parts of this section describe previous research on individuals' dietary knowledge and attitudes, examine the research on the impact of FSP participation on food expenditures, nutrient availability, and nutrient intake, and finally discuss the treatment of selection bias in the literature on the impact of the FSP on food expenditures, nutrient availability, and intake.

1. Dietary Knowledge and Attitudes

a. Theoretical Background

At the most basic level, *nutrition knowledge* represents what people know about the foods they can eat. Recent research, however, has emphasized the multidimensional nature of nutrition knowledge, recognizing that there is not a single construct called "nutrition knowledge" sufficient for capturing the underlying concepts that might relate to dietary behavior (see, for example, Axelson and Brinberg 1992). In a recent review of the literature on the effectiveness of nutrition education,

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[3]Those who are very young, elderly, disabled, or a child's primary caregiver are exempt from the work requirements. Nonexempt household members must register for work (comply with requirements) and accept a suitable job if it is available.

Contento et al. (1995) drew on diffusion of innovation theory and various social-psychological models, noting that the broad term “knowledge” encompasses distinctly different concepts that would be expected to relate to behavior in different ways. They noted that some types of nutrition knowledge can raise awareness, capture attention, and enhance motivation--which they termed “motivational knowledge.” Once an individual has this type of knowledge, however, a different type of knowledge is needed to act on the motivation. Such “how-to” knowledge has been called “instrumental knowledge.”

Closely related to the concept of knowledge is the construct beliefs. Greene and Kreuter (1991) describe a belief as “a conviction that a phenomenon is true or real.” According to Sims (1981), a belief expresses the probability that a relationship exists between two objects or concepts. What generally distinguishes beliefs from motivational knowledge in the literature is the personalization of the knowledge to the individual. The general idea is that a person is more likely to take action if he or she believes the action will result in a good outcome (such as freedom from a disease). It follows, then, that this more personalized belief in the diet-disease connection is more closely related to behavior than the more abstract concept of motivational knowledge.

Sims (1981) stated that, at their simplest, *attitudes* refer to “a feeling of favorableness or unfavorableness toward something, measured along an evaluative continuum.” In a recent review of the literature on attitude-behavior relations, Kim and Hunter (1993) described an attitude as a stable underlying disposition to respond favorably or unfavorably to an object, person, institution, or event.

In the literature on dietary attitudes and their relationship with dietary behavior, researchers have measured attitudes in various ways. For example, Glanz et al. (1993) measured attitudes toward eating low-fat foods through responses to the question, “How important to you is eating low-fat foods?" Colavito et al. (1996) examined the importance of utilitarian features of foods such as price, ease of preparation, perishability, and taste as attitudinal barriers to good dietary practices. Haines et al. (1994) measured attitudes toward dietary guidelines using two factors--one measures the degree to which individuals believe that "avoiding rich foods is important," and the other measures the degree to which they believe that "eating healthy grains is important."

In discussing the relationship between attitudes and behavior, Kim and Hunter (1993) suggested that this relationship may depend on the characteristics of the individual, the object of the attitude, and the social context. These variables can be thought of as modifiers of the influence of attitudes on behavior. As discussed by Contento et al. (1995), the use of social-psychological models that incorporate attitudes and other constructs in the study of dietary and nutrition-related behaviors has grown in recent years. The most widely used are the Health-Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior, the Social Learning/Cognitive Theory, and the Transtheoretical (Stages of Change) Model.

Earlier studies frequently have used some variables based on one or more of these social-psychological models. For example, Patterson et al. (1995) tapped the construct of social norms in a variable called "perceived pressure to eat well." Glanz et al. (1993) examined 11 social-psychological constructs in relation to nutrient intake, including dietary intentions, self-efficacy, self-rated diet, and perceived success in making dietary changes during the previous six months. Using the Health-Belief Model, Colavito et al. (1996) examined self-rated health status, considering it a measure of the construct "internal cue to action." This variable, however, could also be conceptualized as the personal susceptibility component of the "perceived threat" construct in the Health-Belief Model. Haines et al. (1994) developed scales they labeled "macronutrient susceptibility" and "micronutrient susceptibility" to measure the degree to which individuals believe their diets are too high in certain macronutrients or too low in certain micronutrients.

b. Empirical Studies

Nutrition Knowledge. Previous research based on data from the late 1980s and early 1990s concluded that most Americans have a firm grasp of nutrition basics and are aware of the general relationship between diet and health. For example, most individuals can accurately compare the relative nutrient content of different foods and are aware that what a person eats affects his or her chances of getting a disease (Johnson and Johnson 1985; Sloan 1987; and Haines et al. 1994). A recent study examining change over time in nutrition knowledge concluded that "aspects of consumers' nutrition knowledge appear to have increased in recent years, although many gaps remain" (Guthrie et al. 1999). For example, this study found an increased knowledge of recommendations to increase fruit and vegetable intake, but no increase in the awareness of saturated fat as a risk factor for heart disease. Sapp and Jensen (1997), using the 1989-1991 CSFII, looked specifically at the low-income population and concluded that these individuals have good basic nutrition knowledge (instrumental knowledge) but often lack the ability to link the intake of specific nutrients with specific health-related outcomes (motivational knowledge).

Sociodemographic Differences in Dietary Knowledge and Attitudes. Several studies have examined differences in dietary knowledge and attitudes across sociodemographic subgroups. The two most pronounced and consistent findings are associations of age and gender with knowledge and attitudes. Patterson et al. (1995) found that middle-aged adults (ages 35 to 59) have the greatest knowledge of food composition and dietary recommendations, as well as the strongest belief in the diet-cancer relationship. Sapp and Jensen (1997) also found that middle-aged adults (ages 34 to 54) have the greatest nutrition knowledge and diet-health awareness. Glanz et al. (1993) found that older

Americans (all those age 50 or older) have more healthful attitudes and beliefs (with respect to fat and fiber intake) than younger Americans. All these studies found women to be more knowledgeable, to have stronger beliefs in the diet-health relationship, and to have a more positive attitude toward nutrition than men.

Several studies found education and socioeconomic status to be positively associated with dietary knowledge and attitudes (Patterson et al. 1995, Sapp and Jensen 1997; Glanz et al. 1993; and Haines et al. 1994). According to these studies, educational attainment is positively and consistently associated with knowledge of diet-health relationships and food composition. Studies have also found that dietary knowledge and positive dietary attitudes were linked with having high income (Sapp and Jensen 1997) and being a white collar as opposed to a blue collar worker (Glanz et al. 1993). However, these relationships are driven mostly by differences between the groups in educational attainment; for example, after controlling for education, Haines et al. (1994) found that the relationship between income and dietary knowledge is relatively weak.

Relationship Between Dietary Knowledge/Attitudes and Nutrient Intake. A number of studies have focused on the link between dietary knowledge/attitudes and nutrient intake. In reviewing the early literature on this empirical relationship, Axelson and Brinberg (1992) acknowledged that the general finding is that this relationship is weak. They also argued, however, that this apparent weak relationship could be due to an inadequate conceptualization and measurement of nutrition knowledge. Axelson and Brinberg examined 34 studies and found that only 19 reported the reliability coefficients on their measures of nutrition knowledge and that close to half of the reported coefficients did not meet accepted standards for reliability.

Some recent studies also have found weak relationships between measures of dietary knowledge and attitudes and dietary intake. Using reasonably reliable measures of nutrition knowledge and diet-health awareness from the 1989-1991 DHKS and CSFII, Sapp and Jensen (1997) found what they call "low correlations" of these measures with various measures of dietary behavior. Nutrition knowledge turns out to be more likely than diet-health awareness to be correlated with dietary outcomes. Furthermore, nutrition knowledge is correlated with composite measures of dietary behavior more strongly than with individual nutrients or dietary components. Similarly, Haines et al. (1994) found a few relationships between knowledge and attitudes and nutrient intake, but these relationships were not consistent. They found, for example, that, relative to those with low levels of diet-disease awareness, those with greater diet-disease awareness have higher intakes of calories and fiber and lower intake of cholesterol. Haines et al. also found that nutrition knowledge is positively related to fiber and calcium intake. More often than not, however, the estimated relationship between a particular measure of dietary knowledge and the intake of a particular nutrient was not statistically significant.

On the other hand, several recent studies have found a strong relationship between specific measures of dietary knowledge, beliefs, or attitudes and dietary behavior outcomes. In a study using data from Washington State, collected in 1989 and 1990, Patterson et al. (1995) found that both knowledge of dietary recommendations (motivational knowledge) and knowledge of food composition (instrumental knowledge) are significantly associated with fiber and fat intake after controlling for age, gender, education, and self-rated health status. In 1992-1993, follow-up data were collected for this sample, and Patterson et al. (1996) examined the relationship of knowledge to dietary changes over time during the three-year period between 1989-1990 and 1992-1993. They found that knowledge of the National Cancer Institute (NCI) diet and cancer recommendations led to a significant decline in the percent of calories from fat over this period (although this knowledge did not significantly affect fiber intake). Variyam et al. (1995) found that attitudes toward consuming fiber-rich foods and awareness of fiber-disease linkages are important influences on fiber intake (to a greater extent than specific knowledge about the fiber intake of specific foods). Variyam (1999) found that greater awareness of fat- and cholesterol-related health problems and better attitudes toward avoiding excessive fat intake lead to significant reductions in intakes of these nutrients.

Blaylock et al. (1999) examined the relationship between mothers' nutrition knowledge and children's diet quality. They found that greater nutrition knowledge among mothers led to greater diet quality (as measured by the Healthy Eating Index [HEI]) among preschoolers. In particular, preschoolers consumed less total fat, saturated fat, cholesterol, and sodium, and more fiber when their mothers had greater nutrition knowledge. Mothers' nutrition knowledge was insignificantly related to school-age children's overall diet quality.

Two studies have examined the relationship between individuals' *beliefs* in the relationship between diet and health and their dietary behavior. Patterson et al. (1995) used information on whether individuals believe an association exists between diet and cancer and, if so, whether this association is weak, moderate, or strong. They found that belief in the diet-cancer relationship is significantly related to fat and fiber intake (a negative relationship for fat and a positive relationship for fiber). This particular dietary belief also leads to a decline in fat intake and an increase in fiber intake over time (Patterson et al. 1996). Glanz et al. (1993) used data from the Working Well worksite health promotion trial to examine whether individuals' fiber intake is related to the degree to which they believe that "eating a lot of fruits and vegetables decreases my chances of getting serious diseases like heart disease or cancer." They found a positive relationship between this type of dietary belief and fiber intake.

Dietary *attitudes* might also be related to dietary behavior. Using individuals' response to the question, "How important to you is eating low-fat foods?" Glanz et al. (1993) found that a more positive dietary attitude based on this question is strongly and positively related to fiber intake and negatively related to fat intake. Colavito et al. (1996) found that the utilitarian features of foods--taste, price, perishability, and ease of preparation--were significantly related to fat and fiber intake. Individuals who place high importance on these utilitarian features have higher fat intakes and lower fiber intakes. Although they did not find taste to be related to fat intake for this group, they did find taste to be negatively related to fiber intake.

Finally, several studies have examined the relationship between social-psychological measures and dietary behavior. Patterson et al. (1995) found a variable measuring the "perceived pressure to eat well" to be strongly related to fiber intake and marginally related to fat intake. Glanz et al. (1993) examined 11 social-psychological constructs related to fat and fiber intake and found that self-efficacy, self-rated diet, intentions to eat less fat and more fiber, and success in changing one's diet in the past six months are related to fat and fiber intake in the expected directions. Colavito and Guthrie (1996) found a significant relationship between self-rated health status and dietary behavior, with poor health related to lower fat intake.

On the basis of the research on the relationship between dietary knowledge and dietary behavior, two relevant conclusions appear evident. First, dietary knowledge is a multidimensional construct, with distinct subcomponents related to dietary behavior in different degrees. In examining this relationship, though, we need to be clear about how we define measures of nutrition knowledge. Second, studies that "match" a specific measure of dietary knowledge or attitudes with the relevant specific measure of dietary behavior are most likely to yield a significant relationship.

2. Effects of FSP Participation on Dietary Behavior

A large body of literature examines the effects of the FSP on three nutrition-related outcomes: (1) food expenditures, (2) nutrient availability from home food supplies, and (3) nutrient intake. In general, these studies have found positive effects of participation on food expenditures and nutrient availability, but the estimated impacts on nutrient intake are inconsistent and usually statistically insignificant.[4] Studies of the three sets of nutrition-related outcomes are reviewed here; the next section discusses how the research deals with the key methodological issue of selection bias.

Food Expenditures. Research on the question of how food stamp benefits influence household food expenditures has been the most common of the three types of studies. In a review of 17 such studies conducted before 1990, Fraker (1990) found that the studies consistently showed that food stamp benefits are positively and significantly related to household food expenditures.[5] In particular, the marginal propensity to consume (MPC) food out of food stamp benefits in these studies ranged from 0.17 to 0.47, suggesting that each dollar increase in food stamp benefits is associated with additional food expenditures of between $0.17 and $0.47. For example, these estimates of the MPC include 0.17 (Basiotis et al. 1987), 0.20 (Chen 1983), 0.33 (Senauer and Young 1986), 0.37 (West and Price 1976), 0.42 (Devaney and Fraker 1989), and 0.47 (West 1984). A more recent study found that the MPC from food stamps was 0.26 (Levedahl 1995).

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[4]In Chapter VI, we discuss possible reasons for the inconsistencies in the research literature, which shows strong effects of FSP participation on food expenditures and nutrient availability but weak effects on intake.

[5]These studies include Benus et al. (1976); Hymans and Shapiro (1976); West and Price (1976); Neenan and Davis (1977); West et al. (1978); Salathe (1980); Johnson et al. (1981); Brown et al. (1982); Chavas and Yeung (1982); Allen and Gadson (1983); Chen (1983); West (1984); Smallwood and Blaylock (1985); Senauer and Young (1986); Basiotis et al. (1987); Devaney and Fraker (1989); and Fraker et al. (1990). Although these studies indicate that food stamp benefits lead to additional food expenditures, they do not examine whether these additional food expenditures lead to an increase in the quality or quantity (or both) of food purchased.

Each of the studies reviewed by Fraker also provided an estimate of the effect of cash income on food expenditures, thus generating an estimate of the MPC food out of cash income. These results were consistent across studies. Each study found that an increase in cash income led to a statistically significant increase in food expenditures. The magnitude of these effects ranged from an MPC of 0.05 to 0.13. Thus, the effect of food stamp benefits on food expenditures exceeded the effect of cash income on food expenditures by two to nine times.

One limitation of the early research on the effects of food stamp benefits on food expenditures is that it is primarily based on data covering the 1970s, for the most part, prior to the elimination of the purchase requirement. Under the purchase requirement, FSP participants purchased food coupons up to a certain limit, but the face value of the coupons exceeded the purchase price to participants (the difference between the face value and purchase price was considered the benefit amount). Thus, the effects of food stamp benefits under this system of benefits may have differed from the effect of benefits under the current system. Among the studies focusing on food expenditures, only Senauer and Young (1986), Fraker et al. (1990), and Levedahl (1995) used data covering a period after elimination of the purchase requirement.[6]

The main piece of research on the effects of food stamp benefits on food expenditures since 1990 involves evaluations of the food stamp cashout demonstrations. These evaluations examined the effects of food stamp coupons relative to food assistance benefits awarded in the form of cash on food expenditures (defined as including only expenditures on food used at home). These studies were different from earlier research, since the earlier studies examined the effects of food stamp benefits relative to no additional assistance. As summarized by Fraker et al. (1995), three of these

[6]Seven of the 17 studies used data from the low-income supplement of the 1977-1978 Nationwide Food Consumption Survey (NFCS). Other studies used the Consumer Expenditure Diary Survey and the Panel Study of Income Dynamics (PSID).

four cashout demonstrations showed that food expenditures are significantly reduced, by $0.18 to $0.28, for each dollar of benefits cashed out. This finding is consistent with the earlier finding of the MPC from food stamps being $0.17 to $0.47, whereas the MPC from cash income is $0.05 to $0.13.[7]

Nutrient Availability. As with food expenditures, past studies generally have found a positive and significant effect of food stamps on the amount of food households use from their home food supplies (that is, on the foods' nutrient availability). Fraker (1990) focused on six studies, all showing positive and significant effects on some measure of nutrient availability.[8] Using two different data sets, for example, Allen and Gadson (1983) and Devaney et al. (1989) found positive and significant effects of similar magnitude of food stamp benefits on the availability of food energy, protein, vitamin A, vitamin C, thiamin, riboflavin, vitamin B_6, calcium, phosphorus, magnesium, and iron. These effects were three to nine times larger than the effects of cash income, and some of the effects were quite large. Devaney et al. (1989) estimated that participation in the FSP increases the availability of vitamin C, calcium, and iron by 35, 24, and 42 percent, respectively, relative to the RDA.

Like the studies of food stamp impacts on food expenditures, these nutrient availability studies measured the effects of food stamp benefits at the household level. They did not examine how nutrients are distributed within the household. The nutrient availability studies also used relatively old data. Each of the six studies referred to above was based on data from the 1970s; only the

[7]Evaluations of previous cashout demonstrations in Puerto Rico (Devaney and Fraker 1986) and among elderly and disabled recipients (Butler et al. 1985) showed no significant effects of cashing out food stamps. However, neither of these cashout demonstrations used an experimental design.

[8]These studies are Scearce and Jensen (1979); Johnson et al. (1981); Allen and Gadson (1983); Basiotis et al. (1983); Basiotis et al. (1987); and Devaney et al. (1989). Devaney and Moffitt (1991) published a revised version of the results of Devaney et al. (1989).

Devaney et al. (1989) study used data from the period after elimination of the purchase requirement. In addition, the design of these studies allowed them to measure only the effects of food stamp benefits on the amount of foods participants have available within the home. Since food stamp benefits must be used in authorized food retailers (as opposed to restaurants, for example) it is possible that FSP participation may lead to greater nutrient availability within the home but less food consumption outside the home. The nutrient availability studies only pick up this first effect. Finally, the studies examined the effects of benefits on an outcome measure (nutrient availability) that does not distinguish between foods from the home food supply that were (1) consumed by household members, (2) consumed by guests or pets, or (3) were not consumed at all but instead were wasted.

Nutrient Intake. The most direct way to measure whether the FSP has raised "the level of nutrition" of the low-income population is to measure the impact of program benefits on nutrient intake. Previous studies that estimated this effect have shown inconsistent, frequently statistically insignificant, impacts.[9] Fraker (1990) reviewed six early studies of the effects of food stamp benefits on nutrient intake.[10] According to Fraker, these studies "show little consistency; the signs of the estimated food stamp effects often vary greatly across nutrients within the same study and across studies for the same nutrient. Only a small proportion of the estimated food stamp effects are statistically significant." For example, Aiken et al. (1985) estimated food stamp effects on food energy and four nutrients and found no statistically significant effects. Rush et al. (1986) found that

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[9]At first glance, findings of the literature as the effects of participation on nutrient intake appear not to be consistent with studies of the effects of participation on food expenditures and nutrient availability. See Chapter VI for possible explanations that may account for these findings.

[10]These studies are Butler et al. (1985); Aiken et al. (1985); Rush et al. (1986); Butler and Raymond (1986); Basiotis et al. (1987); and Fraker et al. (1990). Butler and Raymond (1996) published a revised version of their 1986 analysis. Two other studies (Price et al. 1978, and Davis and Neenan 1979) were dropped because of a flawed methodology.

20 of the 26 food stamp effects on nutrient intake are positive, but only 1 is statistically significant at the five percent level. One study (Butler and Raymond 1996) found predominantly negative effects of FSP participation on nutrient intake.

More recent studies of the effects of FSP participation on dietary intake have also found inconsistent results. Rose et al. (1998) found significant positive effects of food stamp benefits on intake of 5 of the 15 nutrients they examined. Basiotis et al. (1998) found food stamp benefits to be positively related to diet quality (as measured by the HEI) along with several of its components, but that a variable measuring FSP participation was negatively and significantly related to diet quality. It is not clear whether the net effect of participation and benefits is significant or not. Wilde et al. (1999) found that FSP participation is positively and significantly related to low-income individuals' intake of meats, added sugars, and total fats, but insignificantly related to their intake of fruit, vegetables, grains, and dairy products.

Other recent studies have found little evidence of significant effects of FSP participation. Jensen (1996) found no significant positive effects on two measures of food intake: (1) the number of food groups consumed in a day, or (2) the percentage of calories from fruits and vegetables (Jensen 1996). Blaylock et al. (1999) found FSP participation to be insignificantly related to diet quality (as measured by the HEI) for preschoolers and school-age children. This study also found participation to be insignificantly related to total fat, choleterol, fiber, sodium, calcium, and iron intake among preschoolers, but negatively and significantly related to saturated fat intake. Among school-age children, participation was found to be insignificantly related to total fat, saturated fat, cholesterol, sodium, calcium, and iron intake, but positively and significantly related to fiber intake. Finally, Oliveira and Gunderson (2000) found FSP participation to be insignificantly related to the intake of food energy and eight micronutrients they examined among preschoolers. A recent review of the literature concluded that “whereas the FSP can have both a positive and a negative impact on the intake of specific micronutrients, very few of the estimates are statistically significant” (Levedahl and Oliveira 1999).

Several studies have examined mean nutrient intake among FSP participants and nonparticipants. For example, the Human Nutrition Information Service (1982), using the 1979-1980 Survey of Food Consumption in Low-Income Households, found that participants consume significantly more thiamin, riboflavin, and vitamins A, B_6, and C than do nonparticipants. Using the 1986 CSFII, both Cook et al. (1995) and the Human Nutrition Information Service (1989) found higher consumption among FSP participants of food energy, riboflavin, calcium, folate, iron, magnesium, protein, zinc, and vitamins B_6 and B_{12} among children ages one to five. Lin et al. (1996), using the 1989-1991 CSFII, found that FSP participants consume larger average amounts of iron, calcium, and dietary fiber than nonparticipants. By contrast, the Human Nutrition Information Service (1989) found that, among women ages 19 to 50, FSP participants generally do not consume greater levels of vitamins and minerals than do low-income nonparticipants. Bialostosky and Briefel (2000), using data from the 1988-1994 National Health and Nutrition Examination Survey (NHANES), also found no significant differences between the mean nutrient intake levels of participants and eligible nonparticipants.

3. Treatment of Selection Bias

An important issue in the literature on the impact of food stamp benefits on food expenditures, nutrient availability, and nutrient intake is that of selection bias. Selection bias arises when FSP participants and nonparticipants differ in ways that are not observable, and these differences influence such dependent variables as expenditures, availability, and intake.

The most common approach to dealing with selection bias in the nutrient intake models is to try to explicitly control for all relevant factors that may be related to FSP participation (and influence nutrient intake) in the nutrient intake models.[11] However, it is difficult to measure all such relevant factors, and critics often point out factors that may be excluded from these models. The most commonly cited of these factors are measures of dietary knowledge or dietary attitudes. For example, Fraker (1990) suggests that participants may differ from eligible nonparticipants in their "knowledge of nutritional requirements." Butler and Raymond (1996) suggest the possibility that "those who care more about nutrition are at the same time more likely to apply for and receive food stamps and maintain a nutritionally adequate diet."[12]

Without being able to control explicitly for all relevant factors, an alternative approach is to deal with selection bias econometrically. Heckman (1978, 1979) and Heckman and Robb (1985) developed methods that can be used for estimating the unobserved factors that affect FSP participation by including a constructed variable in the nutrient intake equation that controls for these unobserved factors. To determine the effects of FSP participation on food expenditures, nutrient availability, or nutrient intake, several studies have estimated these selection-correction models--for example, Chen 1983; Aiken et al. 1985; Fraker et al. 1990; Devaney and Moffitt 1991; Butler and Raymond 1996; and Jensen 1996.

A drawback of selection-correction models of this type, however, is that the results are often quite sensitive to the exact specification used. In particular, the models must include variables that

[11]See Devaney et al. (1989) for a discussion of selection bias in the context of nutrient availability models.

[12]Another type of selection bias that can arise, and is not as much discussed in the research literature, is that the programs may attract "needier" individuals who may have poorer diets compared to other apparently similar individuals. For instance, certain low-income individuals who have nutritional deficiencies may get referred to the FSP, as might those participating in other programs for low-income individuals (such as the AFDC/TANF or Medicaid programs).

are strongly correlated with FSP participation but that are not related to nutrient intake (or to food expenditures or nutrient availability). These "identifying" variables are difficult to find in practice, and use of inappropriate identifying variables (variables correlated with the outcome of interest) will lead to models that are misspecified.

One approach to dealing with selection bias is to use a rich data set and to control explicitly for as many relevant factors as possible that influence food intake. The data sources used in this study do not contain good identifying variables to estimate selection bias models--variables that are strongly correlated with food stamp participation without being correlated with nutrient intake. However, the data set is a rich source of information on factors affecting food intake. In particular, the data set contains a great deal of information on the dietary knowledge and attitudes of low-income individuals. In this study, a set of composite measures of dietary knowledge and attitudes is constructed in an attempt to prevent dietary knowledge type of selection bias from strongly influencing the results. The data set also contains information on income, asset holdings, program participation, and self-reported health status that can be used to attempt to control for the selection of those with poorer diets into the FSP.

II. DATA AND METHODS

The analysis presented in this report was based on the 1994-1996 Continuing Survey of Food Intakes by Individuals (CSFII) and the Diet and Health Knowledge Survey (DHKS). This chapter describes the data sources and sample used for the analysis, then outlines the key methodological issues.

A. DATA SOURCE

The 1994-1996 CSFII/DHKS, conducted by the Agricultural Research Service (ARS) of the USDA, was based on three independently drawn, nationally representative samples of the noninstitutionalized population residing in the United States. The three samples were drawn to be representative of the U.S. population in 1994, 1995, and 1996; these samples were combined in this analysis to obtain a representative sample for the three-year period. The CSFII/DHKS samples were drawn using stratified, clustered, multistage sampling techniques. Low-income individuals in the population were oversampled. The descriptive analysis in this report (Chapters III and IV) used sample weights to adjust for nonresponse and the oversampling of low-income individuals.[1]

The response rates for the 1994-1996 CSFII/DHKS were relatively high. The response rates were 80 percent for the first day of CSFII dietary intake data, 76 percent for two days of dietary intake data, and 74 percent for the DHKS.[2]

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[1]In the multivariate analysis (Chapter V), sample weights generally were not used. However, the robustness of the multivariate results was assessed by estimating weighted regression models for selected outcomes. The weighted and unweighted analysis produced similar results.

[2]Earlier panels of the CSFII/DHKS had much lower response rates. For example, the 1989-1991 panels of the CSFII/DHKS had response rates of 58 percent for the first day of dietary intake data, 45 percent for three days of dietary intake data, and 57 percent for the DHKS.

The 1994-1996 CSFII collected information on the dietary intake of all sample members on two nonconsecutive days during the survey year, using 24-hour recalls during in-person interviews. Data on the second day of dietary intake for an individual usually were collected 3 to 10 days after data on the first day of dietary intake were collected, as well as on a different day of the week.[3]

Nutrient intake in the CSFII was based on all foods and beverages ingested over the 24-hour period (inedible parts of foods were not included). Sugar and alcohol consumption were also calculated. CSFII nutrient intakes do not include vitamin and mineral supplements, although separate data were collected on the frequency and type (but not amount) of vitamin and mineral supplements used. In addition, the sodium intake amount included in the CSFII data set does not include sodium from salt added at the table.

The CSFII also collected information on household income, food stamp and other program participation status, health status, and other socioeconomic characteristics. A total of 16,103 sample persons completed the 1994-1996 CSFII Day 1 intake, including 4,488 low-income individuals (that is, individuals in households whose income is no more than 130 percent of the federal poverty line).

The DHKS was conducted as a telephone followup for a subsample of the CSFII sample. For each household where all CSFII sample members had complete data for at least one day of dietary intake, or where members were determined to be Day 1 nonrespondents, a single DHKS respondent was randomly selected from among eligible CSFII sample members age 20 or older. DHKS interviews were scheduled with this sample member approximately two to three weeks after the

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[3]The previous round of the CSFII (the 1989-1991 CSFII) collected dietary intake data on three consecutive days. With data collected from sample members on two days in the 1994-1996 CSFII, the variability of dietary intake will be higher than if three days of intake data had been collected from the same number of sample members. On the other hand, the fact that the intake days were not consecutive days in the 1994-1996 CSFII leads to lower variability than if the days had been consecutive.

completion of the second day of dietary intake data collection. The DHKS survey includes information on dietary knowledge, attitudes, and practices and can be linked to the CSFII data. The total DHKS sample size is 5,765 adults, including 1,644 low-income adults.

Not all CSFII sample households had a DHKS respondent, for two reasons. First, sample members were not eligible if their intake had been completed by proxy, nor were proxies allowed to complete the DHKS. The second reason was the DHKS requirement that all respondents be at least 20 years old.

B. ANALYSIS SAMPLE

1. Population of Interest

The primary focus of this study involves the dietary intake and dietary knowledge, attitudes, and behavior of the low-income population. Thus, low-income individuals constitute the population of interest for the study. Low-income individuals were defined as those living in households with incomes between 0 and 130 percent of poverty (which is the gross income eligibility level for the FSP).[4] For purposes of comparison, individuals living in households with incomes above 130 percent of poverty were also included in the descriptive analysis. For simplicity, these individuals are referred to in the report as high-income individuals.

2. Distinguishing Food Stamp Participants from Low-Income Nonparticipants

Because much of the analysis in the report involved distinguishing FSP participants and low-income nonparticipants, we estimated the FSP participation rate among low-income individuals using CSFII data and compared it with estimated participation rates among the eligible population

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[4]A few households that receive food stamps have reported incomes above 130 percent of poverty. Despite their income, we considered individuals in these households to be low-income individuals because of their food stamp status.

as reported in other studies. The CSFII-based participation rate turned out to be substantially lower than the participation rate estimates from these other studies. For example, while CSFII data suggest that 38 percent of individuals in households with incomes of no more than 130 percent of poverty received food stamps, Stavrianos (1997), using data from the Food Stamp Quality Control data system, found that 71 percent of individuals in FSP-eligible households received food stamps.

There are a number of potential explanations for this discrepancy. The CSFII participation rate reported above is based on individuals in households with incomes of no more than 130 percent of poverty, but this is only an approximation of the FSP-eligible population. For all households, criteria other than gross income--such as asset limitations--are also used to determine FSP eligibility. The only requirement for FSP eligibility among elderly households is that their net income be no more than 100 percent of poverty (regardless of their gross income). Thus, for both elderly and nonelderly households, some individuals in households with incomes of no more than 130 percent of poverty may have been ineligible for food stamps.[5]

Because the CSFII did not explicitly attempt to define households' FSP eligibility status, the analysis in this report used the income threshold described above to proxy for eligibility. In interpreting the results of the analysis, however, readers should bear in mind that low-income nonparticipants may include individuals from households that were not eligible to receive food stamps. Chapter V includes a description of a variety of sensitivity checks that examined the extent to which the results (that is, the estimated relationship between participation and dietary intake) changed with alternative definitions of low-income households (in particular, low-income households not receiving food stamps). These sensitivity tests show that participation rate

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[5]An alternative explanation for the discrepancy in the FSP participation rate reported in this study versus that reported in Stavrianos (1997) involves misreporting. For instance, individuals are often found to significantly underreport income as well as program participation in survey data.

differences do not change any of the main findings on the impacts of FSP participation on nutrient intake or other key outcomes.

3. CSFII Versus DHKS Samples

Given the differences between the sample frames of the CSFII and DHKS, the sample of low-income individuals examined differs according to the outcome being examined. In Chapter III, DHKS data are used to examine individuals' dietary knowledge and attitudes; thus the sample is limited to adults age 20 and older who responded to the DHKS (the DHKS sample). This sample also was limited to those with both days of dietary intake data. The resulting sample size is 1,466.

For the analysis in Chapters IV and V, where measures of dietary intake are the focus, the larger sample of individuals who responded to the CSFII (the CSFII sample) is used.[6] This sample also is limited to individuals who have two days of valid dietary intake data, who are one year of age or older, and who are not breast-feeding.[7] The resulting sample size is 3,935.

Although the DHKS sample used for the descriptive analysis of dietary knowledge is limited to adults, the CSFII sample providing dietary intake data includes individuals of all ages. In analyzing these data, preschoolers (ages 1 through 4), school-age children (ages 5 through 18), and adults (age 19 and older) are examined as separate groups. We analyze these age groups separately because consumption patterns and dietary practices are likely to vary widely across these groups, and the dietary effects of FSP participation might also vary across these groups. Furthermore, previous

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[6]In the multivariate analysis in Chapter V, the key dependent variables are measures of dietary intake, but the models for adults include dietary knowledge and attitude variables as independent variables. In this analysis, the larger CSFII sample is used, and the values of the DHKS-based variables for adults are imputed when the values are missing by using mean values of the variables among nonmissing cases.

[7]Also excluded was one individual who reported eating nothing on one of the intake days but who did not report being on a diet or that the amount consumed was "less than usual."

studies examining the effects of participation have isolated one or more of these groups. Thus, by separating the groups in the analysis, the results will be more comparable to the existing literature.

4. Sample Characteristics

Table II.1 shows the unweighted characteristics of low- and high-income sample members and food stamp participants and nonparticipants from the DHKS and CSFII samples (with the three age groups combined). Except for the sample members' ages and whether or not the respondent was the main meal planner, the characteristics of the DHKS and CSFII samples are reasonably similar. In each sample, slightly more than 20 percent of low-income sample members lived in households with incomes below 50 percent of the poverty line, and another 40 percent lived in households with incomes between 50 and 100 percent of the poverty line. About one-third of each low-income sample received food stamps. Women, Infants, and Children (WIC) participation was much less common, with about 5 percent of low-income CSFII sample members (including children) and 1.5 percent of low-income DHKS sample members (limited to adults) receiving WIC benefits. Finally, both samples had relatively low levels of educational attainment. More than one-third of the low-income adults in each sample were high school dropouts, while only 29 percent had attended any postsecondary school.

The low- and high-income samples differed in a number of characteristics. High-income sample members (in both the DHKS and CSFII samples) were less likely than low-income sample members to be female, were more likely to be white and non-Hispanic, and, on average, had higher educational attainment. Because of income eligibility requirements, no high-income individuals were food stamp or WIC participants.

TABLE II.1

SAMPLE CHARACTERISTICS, UNWEIGHTED
(Percentages)

	DHKS Sample				CSFII Sample			
	All		Low-Income		All		Low-Income	
Characteristic	Low-Income	High-Income	FSP Participants	Nonparticipants	Low-Income	High-Income	FSP Participants	Nonparticipants
Income as a Percentage of Poverty								
<= 50 percent	21	0	29	17	23	0	35	16
51-100 percent	42	0	41	42	41	0	39	42
101-130 percent	38	0	30	41	36	0	26	42
131-185 percent	0	12	0	0	0	13	0	0
185-299 percent	0	24	0	0	0	25	0	0
>= 300 percent	0	63	0	0	0	62	0	0
Age (in years)								
1-3	--	--	--	--	7	3	10	5
4-10	--	--	--	--	13	7	19	9
11-18	--	--	--	--	12	8	15	10
19-60	75	80	86	70	53	66	49	56
> 60	25	20	14	30	15	16	8	20
Gender								
Male	39	50	34	41	43	50	42	44
Female	61	50	66	59	57	50	58	56
Race/Ethnicity								
White, Non-Hispanic	52	80	42	56	47	79	39	52
Black, Non-Hispanic	24	9	36	19	25	9	34	19
Hispanic	19	7	17	20	22	7	20	24
Other	5	4	5	5	6	4	6	5
Educational Attainment (adults only)								
Less than high school	38	9	41	37	36	8	37	34
High school degree only	33	28	31	34	36	28	36	36
Greater than high school	29	63	28	29	29	64	27	30
Program Participation								
Food Stamp Program	32	0	100	0	37	0	100	0
WIC	2	0	2	1	5	0	9	3
Main Meal Planner								
Yes	72	61	77	70	47	48	43	50
No	28	39	23	30	53	52	57	50
Pregnant/Lactating (females only)								
Yes	2	1	2	2	1	1	1	2
No	98	99	98	98	99	99	99	98
Self-Reported Weight Status								
Overweight	45	47	58	38	--	--	--	--
Underweight	6	6	7	6	--	--	--	--
About right	49	46	35	56	--	--	--	--
Sample Size	**1,466**	**4,131**	**436**	**1,030**	**3,935**	**10,842**	**1,463**	**2,472**

SOURCE: 1994-1996 CSFII and DHKS.

NOTE: The DHKS sample consists solely of individuals age 20 or older. The CSFII sample consists of individuals age 1 or older.

Some differences were observed in the economic and demographic characteristics of food stamp participants and low-income nonparticipants. For instance, program participants were more likely to be younger than other low-income nonparticipants and were less likely to be white. Participants also were considerably more likely to have lower income levels as a percentage of poverty, compared with other low-income nonparticipants. FSP participants were also more likely to report that they were overweight.[8] Individuals in the two groups, however, had fairly similar levels of educational attainment.

C. MEASURING DIETARY OUTCOMES

This section discusses how dietary knowledge and attitudes, dietary behavior toward fat, and dietary adequacy were measured.

1. Measuring Dietary Knowledge and Attitudes

We had two goals in defining composite variables that measure dietary knowledge and attitudes. The first was to summarize individuals' attitudes and beliefs about their diets and measure their knowledge of important nutritional concepts in an efficient way. The second was to develop a limited set of measures that made it possible to control for dietary knowledge and attitudes in the multivariate models used in Chapter V of this report to determine the effects of food stamp participation on dietary intake.

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[8]Self-reported weight was collected as part of the DHKS, so this outcome was not available for the CSFII sample. However, the CSFII did collect information on sample members' height and weight, which showed that FSP participants are more likely than nonparticipants to be overweight (see Appendix B), a finding corroborated by Bialostosky and Briefel (2000) using NHANES data. Appendix B also shows that FSP participants are more likely to smoke and to report their health status as fair or poor as opposed to good or very good.

The DHKS contains more than 100 data items with information on dietary knowledge, attitudes, and practices. The strategy for summarizing this information, as well as the resulting composite measures of dietary knowledge and attitudes, drew heavily on the Haines et al. (1994) analysis of dietary knowledge and attitudes in the United States using the 1989 CSFII/DHKS. In that work, Haines et al. use the Health-Belief Model as a theoretical rationale for examining particular aspects of dietary knowledge and attitudes. They then identify a group of items related to each of these aspects and use principal components analysis to determine the dimensionality of these sets of items and to select the particular items to be included in each construct. Finally, they assess the internal consistency, reliability, and validity of each of the item sets used in each of their dietary knowledge and attitude constructs. The basic strategy used here consisted of the following steps:

- ***Step 1.*** Using theoretical research (and previous empirical research), general categories of dietary knowledge and attitudes were identified for further investigation. These general categories were defined according to the DHKS items to be investigated, for use in a specific measure. The categories included three separate groups of items representing nutrition knowledge and three additional groups of items representing (1) dietary beliefs, (2) general dietary attitudes, and (3) perceived nutrient susceptibility.

- ***Step 2.*** Principal components analysis was used on each of these sets of DHKS items to determine whether a given set of items should be grouped together to create a single knowledge or attitude measure or separated to create more than one measure.

- ***Step 3.*** A final set of items was generated for defining a particular measure, and reliability analysis was conducted to determine whether this set of DHKS items reliably represented an underlying knowledge or attitude factor.

- ***Step 4.*** Once a reliable and meaningful factor was identified, the scales to be used in this analysis were created by either summing or averaging the values of the contributing items for each factor.

Since the analysis in this study examined dietary knowledge and attitudes as they relate to dietary intake, our review of the theoretical and empirical considerations that influence the creation of knowledge and attitude measures focused on how dietary knowledge and attitudes influence dietary intake. Based on a review of the literature, knowledge and attitudes that are associated with dietary intake can be broadly classified into four areas: (1) nutrition knowledge, (2) dietary beliefs, (3) general dietary attitudes, and (4) attitudes based on social-psychological models. For each area, the relevant empirical considerations are discussed and the composite measure that was created, based on the principal components analysis, is briefly summarized.[9] Table II.2 contains a summary of the factors included in the study, as well as a brief description of what each factor measures.

a. Nutrition Knowledge

As described in Chapter I, nutrition researchers have become more sophisticated in their conceptualization of nutrition knowledge in recent years, recognizing nutrition knowledge as a multidimensional construct. This study draws on the conceptualization of knowledge as multidimensional. It was hypothesized that the items in the DHKS supported the construction of three measures of nutrition knowledge: (1) diet-disease relation awareness, (2) knowledge of Food Guide Pyramid servings recommendations, and (3) knowledge of foods' fat and cholesterol content.

Diet-Disease Relation Awareness Factor. This measure reflects individuals' knowledge of health problems associated with the following seven dietary practices: (1) eating too much fat, (2) not eating enough fiber, (3) eating too much salt, (4) not eating enough calcium, (5) eating too much cholesterol, (6) eating too much sugar, and (7) being overweight. The DHKS asked individuals to identify any health problems they are aware of that are related to these seven specific dietary practices. We developed a list of primary health problems associated with each dietary practice, then

[9]This section contains a general description of the factors (or scales) used in the analysis. Appendix A contains details on the items that go into the creation of these composite measures, as well as other details related to the creation of the factors.

TABLE II.2

DIETARY KNOWLEDGE AND ATTITUDE SCALES

Factor	Description	Range
Nutrition Knowledge		
Diet-Disease Relation Awareness Factor	Reflects individuals' knowledge of the primary health problems associated with specific dietary practices (such as eating too much fat, not eating enough fiber)	0-7[a]
Pyramid Servings Recommendations Knowledge Factor	Reflects the number of servings of each of five food groups that respondents think a person should eat	0-5[a]
Knowledge of Foods' Fat and Cholesterol Content Factor	Reflects knowledge of the fat and cholesterol content of foods	0-1[a]
Dietary Beliefs		
Belief in the Diet-Health Relationship Factor	Reflects individuals' belief that an association exists between diet and health (regardless of their knowledge about the scientific research in the area)	1-4[b]
General Dietary Attitudes		
Nutrition Importance Factor	Reflects the importance individuals place on dietary guidelines (such as choosing a diet low in fat and cholesterol, eating a variety of foods)	1-4[c]
Social-Psychological Related Attitudes		
Perceived Micronutrient Susceptibility Factor	Reflects the degree to which respondents feel their diets are too low in the following nutrients: calcium, iron, vitamin C, protein, and fiber	0-1[d]
Perceived Macronutrient Susceptibility Factor	Reflects the degree to which respondents feel their diets are too high in the following nutrients: energy, fat, saturated fat, cholesterol, salt, and sugar	0-1[d]

NOTE: The methodology used to construct these scales was based closely on the methodology used to construct dietary knowledge and attitude composite measures by Haines et al. (1994).

[a] The higher the value, the greater the individual's knowledge of the aspect of nutrition that the factor reflects.

[b] The higher the value, the greater the individual's belief in this relationship.

[c] The higher the value, the greater the personal importance individuals place on these guidelines.

[d] The higher the value, the more individuals believe their diets are too low (high) in these micro (macro) nutrients.

created variables that indicated whether individuals correctly identified at least one of these health problems.[10]

The "diet-disease relation awareness factor" was constructed by summing the values of the seven binary variables indicating whether individuals were aware of the primary health problems associated with each of the seven specific dietary practices. This factor measures motivational knowledge and takes on values from 0 to 7, with higher values representing a greater awareness of the link between dietary practices and health problems.

Knowledge of Pyramid Servings Recommendations Factor. Another way of measuring individuals' nutrition knowledge is to measure their knowledge of the USDA Food Guide Pyramid servings recommendations. The USDA Food Guide Pyramid provides recommended numbers of servings of five major food groups: (1) fruits; (2) vegetables; (3) milk, yogurt, and cheese; (4) bread, cereal, rice, and pasta; and (5) meat, poultry, fish, dry beans, and eggs (U.S. Department of Agriculture 1992). The recommendations fall into ranges, with the exact number of servings depending on individuals' food energy needs.[11] The DHKS asked respondents to estimate the number of servings of each of the food groups they think "a person of their age and sex should eat each day for good health." On the basis of their responses to these DHKS items, a set of five binary variables were created that indicated whether individuals' estimates for each food group fell into the recommended range.

The "pyramid servings recommendations knowledge factor" was constructed by summing the values of these five binary variables. This factor measures individuals' instrumental knowledge,

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[10]Appendix A lists the specific primary health problems linked to dietary practices.

[11]The recommended ranges are 2 to 4 servings of fruit, 3 to 5 servings of vegetables, 2 to 3 servings of dairy products, 6 to 11 servings of grain products, and 2 to 3 servings of meat and meat substitutes.

taking on values between 0 and 5 indicating the number of food groups for which an individual knows the number of recommended servings. Higher values of the factor indicate a greater knowledge of USDA dietary recommendations.

Knowledge of Foods' Fat and Cholesterol Content Factor. The third set of DHKS items that appear to measure a distinct aspect of nutrition knowledge includes 14 items measuring respondents' knowledge of the fat and cholesterol content of foods. On the basis of the responses to these items, a set of 14 binary variables were created that indicated whether individuals had specific (and correct) information about foods' fat and cholesterol content.

The "knowledge of foods' fat and cholesterol content factor" was created by averaging the values of the 14 binary variables. This factor also measures individuals' instrumental knowledge. It takes on values between 0 and 1 and can be interpreted like a test score. Higher values of the factor indicate greater knowledge of foods' fat/cholesterol content.

b. Dietary Beliefs

In this study, a single DHKS item was used to measure individuals' dietary beliefs. The item asked respondents the extent to which they believed the following statement: "What you eat can make a big difference in your chance of getting a disease, like heart disease or cancer." This factor reflects individuals' belief that an association exists between diet and health. It is measured on a scale of 1 to 4, with 1 indicating strong disagreement and 4 indicating strong agreement. High values of this factor indicate a strong belief that dietary practices affect one's health status.

c. General Dietary Attitudes

Sims (1981) states that, at their simplest, attitudes refer to "a feeling of favorableness or unfavorableness toward something, measured along an evaluative continuum." In a review of the literature on attitude-behavior relations, Kim and Hunter (1993) describe an *attitude* as a stable underlying disposition to respond favorably or unfavorably to an object, person, institution, or event.

In the literature on dietary attitudes and their relationship with dietary behavior, researchers have measured attitudes variously. Glanz et al. (1993), for example, measure attitudes toward eating low-fat foods through responses to the question, "How important to you is eating low-fat foods?" Colavito et al. (1996) examine the importance of utilitarian features of foods such as price, ease of preparation, perishability, and taste as attitudinal barriers to good dietary practices. Haines et al. (1994) measure attitudes toward dietary guidance, using two factors--one that measures the degree to which individuals believe that "avoiding rich foods is important" and another that measures the degree to which they believe that "eating healthy grains is important."

Adults' dietary attitudes were measured using a set of DHKS items that asked individuals how important various positive dietary practices were to them. In particular, they rated on a scale of 1 (not at all important) to 4 (very important) the importance to them of a set of 11 statements representing the *Dietary Guidelines for Americans*. The "nutrition importance factor" was created by averaging the values of the 11 contributing items. This factor measures individuals' attitudes toward nutrition in general and reflects the importance individuals place on dietary guidelines. It takes on values in the range 1 to 4, with higher values indicating more favorable attitudes toward following guidelines for good nutrition.

d. Attitude Constructs Based on Social-Psychological Models

Haines et al. (1994) developed two attitude constructs: (1) the perceived macronutrient susceptibility factor, and (2) the perceived micronutrient susceptibility factor. Following Haines et al. (1994), and in accordance with the Health-Belief Model, this study developed these perceived susceptibility factors as well. The factors were based on DHKS items that measured the extent to which respondents thought their diets were too high, too low, or about right in 11 different nutrients. The "perceived micronutrient susceptibility factor" measures the extent to which individuals feel their diets are *too low* in calcium, iron, vitamin C, protein, and fiber. The "perceived macronutrient susceptibility factor" measures the extent to which individuals feel their diets are *too high* in calories, fat, saturated fat, cholesterol, salt/sodium, and sugar and sweets. Each factor was created by averaging the values of the binary variables that contribute to it; thus, each takes on values between 0 and 1. Higher values of the factors indicate greater susceptibility--belief that their diets are too low in "good things" or too high in "bad things."

2. Measuring Dietary Behavior Toward Fat

Ultimately, individuals' dietary knowledge and attitudes are important because of their potential influence on nutrient intake. Knowledge and attitudes, however, can affect intake only through their effect on dietary habits or practices--eating different types or amounts of food and/or preparing the food in different ways. Thus, dietary habits are an intermediate variable in a potential link between dietary knowledge/attitudes and dietary intake.

One might expect the relationship between knowledge/attitudes and habits to be stronger than the relationship between knowledge/attitudes and intake because of the specificity of the variables representing habits versus those representing intake. Dietary intake for a particular nutrient or food component (such as dietary fat) is a reflection of the intake of a wide variety of foods about which an individual would have different knowledge and attitudes. Two people could reach the same dietary fat intake level, as measured through 24-hour recalls, with very different food consumption patterns. By contrast, dietary habits or practices are specific events over which individuals have more direct control. With this more direct control, dietary knowledge and attitudes should directly affect dietary habits and practices. The effect of dietary knowledge and attitudes on nutrient intake, by contrast, could be weakened by limited dietary knowledge or by conflicting dietary habits.

We examined 19 DHKS items that measure dietary habits or behavior as they relate to fat intake. These items were similar to variables used in Kristal's dietary behavior indexes (Kristal et al. 1990) and included indicators of how often individuals did things such as eat meat, eat fried chicken, add butter or margarine to potatoes or vegetables, or drink whole milk rather than skim milk. All 19 items were rescaled so that each took on values between 1 and 4, with 1 indicating that an individual never practices a good dietary habit (or always practices a bad one) and 4 indicating that the individual always practices a good dietary habit (or never practices a bad one).

The "dietary behavior factor" was created by averaging the values of the 19 contributing items. This factor takes on values between 1 and 4, with higher values representing dietary practices that are more nutritious in that they lower individuals' intake of dietary fat.

3. Measuring Dietary Intake and Nutritional Quality

A high-quality diet is one that, on average, provides enough energy and essential nutrients to meet basic nutrient requirements but does not include excessive amounts of fat, saturated fat, cholesterol, and sodium. The nutritional quality of individuals' diets was measured in this study by examining the degree to which individuals' usual dietary intakes met nutrient requirements while conforming to dietary guidelines regarding the intake of dietary components such as fat and cholesterol.

This study relied on dietary intake data from the CSFII, which used a 24-hour recall dietary assessment method that required limited respondent memory and minimized the likelihood that individuals would modify their food habits in response to the data collection effort. Methods that use a 24-hour recall have several limitations, however. First, they reflect current, rather than usual, intake. The short period over which this information is collected raises questions about the accuracy of the data as a measure of true consumption, since there is likely to be a great deal of day-to-day variation in consumption patterns (Beaton 1994). Second, these methods rely on individuals' recall of food consumption from an earlier period. According to Acheson et al. (1980), "the success of the 24-hour recall depends on the subject's memory, the ability of the respondent to convey accurate estimates of portion sizes consumed, the degree of motivation of the respondents, and the skill and persistence of the interviewer." Finally, for most nutrients, measurement of dietary intake alone is insufficient to assess the nutritional status of an individual. Rates of absorption, utilization, and excretion of nutrients may vary from individual to individual, as do other lifestyle and health characteristics (which affect individuals' nutrient requirements).

Despite the limitations of 24-hour recall dietary intake data, this type of data remains a useful way to measure individuals' dietary quality. This study used 24-hour recall dietary intake data from the CSFII to describe low-income individuals' dietary adequacy and to measure the effects of food stamp participation on dietary adequacy. This section describes several issues related to the use of nutrient intake data and other measures of dietary quality available in the CSFII/DHKS.

a. Nutrient Intake

Nutrients to Be Examined. This study examined individuals' intake of a fairly comprehensive set of nutrients and dietary components. The *1995 Third Report on Nutrition Monitoring in the United States* identified eight dietary components that warrant priority status in public health monitoring because they are underconsumed or overconsumed by the U.S. population as a whole or by subgroups of the population: (1) food energy, (2) total fat, (3) saturated fat, (4) cholesterol, (5) alcohol, (6) iron, (7) calcium, and (8) sodium. The report also recommended several other macronutrients and vitamins and minerals for which further study is required, including carbohydrates, fiber, sugars, polyunsaturated fats and other fats and fat substitutes, protein, vitamin A, vitamin C, vitamin E, carotenes, folate, vitamin B_6, vitamin B_{12}, magnesium, potassium, zinc, copper, selenium, phosphorus, and fluoride. As shown in Table II.3, all of these nutrients were examined except for carotenes, potassium, copper, and selenium, for which either RDA values are not available or intake amounts are not available in the CSFII.[12]

Measuring Nutrient Intake. Information on individuals' nutrient intake is presented in two ways to describe and measure the nutrient adequacy of these intakes. The first is mean intake. Although daily intake data were used, the mean daily intake of a given nutrient across the full sample (or for a given subgroup) is an unbiased estimate of the mean usual intake of that nutrient for the relevant population group. Mean intake is measured either in absolute terms or as a proportion of the relevant dietary standard (discussed below). The second way of measuring and presenting intake data involves using some characterization of the *distribution* of individuals' usual intakes across the population. Although mean intake levels are useful, they do not address some important questions about a group's overall nutritional status. In particular, current public health concerns focus on the overconsumption and underconsumption of key nutrients. These concerns are addressed by measuring the proportion of sample members whose usual intake of a particular nutrient is especially low or high by comparing their intake to specific dietary standards.

Defining Dietary Assessment Standards. To assess the intake of nutrients and other dietary components, three sources were used: (1) Recommended Dietary Allowances (RDAs); (2) *Dietary*

[12]In addition, several nutrients not identified as current or potential future public health issues were also examined in this study, including thiamin, niacin, and riboflavin, because RDA values are available for these nutrients and it is possible that they may become public health issues in the future.

TABLE II.3

KEY NUTRIENTS AND DIETARY COMPONENTS EXAMINED IN THE STUDY

Macronutrients	Vitamins	Minerals	Other
Food Energy	Vitamin A	Calcium	Cholesterol
Protein	Vitamin B_6	Iron	Dietary Fiber
Carbohydrate	Vitamin B_{12}	Magnesium	Sodium
Total Fat	Vitamin C	Phosphorus	Alcohol
Saturated Fat	Vitamin E	Potassium	Sugar and Sweets
	Folate	Zinc	
	Niacin		
	Riboflavin		
	Thiamin		

Guidelines for Americans; and (3) recommendations presented in *Diet and Health,* by the National Research Council (NRC) (National Research Council 1989a). RDAs provided dietary standards for the intake of food energy and micronutrients (vitamins and minerals); the second and third sources provided standards for the intake of macronutrients and other dietary components.

The most commonly used guidelines on nutritional requirements are the RDAs compiled by the Food and Nutrition Board of the NRC. RDAs for each nutrient are set using the following criterion: RDAs are "the levels of intake of essential nutrients that, on the basis of scientific knowledge, are judged by the Food and Nutrition Board to be adequate to meet the known nutrient needs of practically all healthy persons" (National Research Council 1989b). For each nutrient, the board sets age- and gender-specific average daily requirements for a reference person of given weight and height. For proteins, vitamins, and minerals, the levels are set at two standard deviations above the mean. Even within groupings, however, considerable variation exists in nutrient requirements among people, and the established RDA levels provide adequate nutrient intake for almost all healthy individuals. Thus, there is a substantial "safety margin" in the RDAs as they apply to most *individuals;* intake for an individual below the RDA does not necessarily indicate inadequate nutrition.[13]

Similarly, the mean intake of a given nutrient relative to the RDA is a useful descriptive indicator and can be used to compare the average intake of that nutrient for one group versus another group. However, it is not appropriate to use the mean nutrient intake of a group relative to the RDA

[13]The Food and Nutrition Board is currently updating and expanding the RDAs through the creation of new Dietary Reference Intakes (DRIs). Although the RDAs specify the amounts of nutrients needed to ensure that individuals are protected against possible nutrient deficiency, the DRIs are designed to incorporate the latest understanding of nutrient requirements based on optimizing health in individuals and groups. Because work in developing DRI standards and the appropriate methods for interpreting their use is not yet completed, the old RDAs are used in this study.

to assess the adequacy of that intake for the group. Even if the mean intake exceeds the RDA, it is possible that a substantial number of individuals within that group have intakes of the nutrient that do not meet their individual nutrient requirements.

The Recommended Energy Allowance (REA) for food energy is set using a different approach than the RDAs for the other nutrients. The Food and Nutrition Board sets the REA for individuals of different age and gender groups according to its estimate of the *average* energy needs of that population group, rather than at an amount sufficient to meet the needs of *most individuals*. Thus, it is desirable that average food energy intake be approximately equal to the REA.

RDAs are defined in terms of average, or usual, consumption of nutrients over time. Thus, good health does not necessarily require that a person consume at the RDA levels every day. In the analysis described in this study, to calculate the percentage of a sample meeting a specified percentage of the RDA for a given nutrient, an estimate was calculated of the distribution of usual intake of the nutrient, based on the two-day observation of dietary intake (using a procedure described below). Furthermore, for most of the analysis, a threshold nutrient intake level below the RDA was used to serve as an indicator of deficiency. In particular, similar to Cook et al. (1995), the percentage of the population with nutrient intakes below 70 percent of the RDA was used as an estimate of the percentage with inadequate intake of a given nutrient. This 70 percent threshold was somewhat arbitrarily chosen, but it is an approximation of the mean nutrient requirement for the nutrient in the population.

Although the RDA standards do not address intake of key macronutrients (such as total fat and saturated fat) and other food components (such as sodium and cholesterol), the nutrition community and general population are increasingly aware of the importance to good health of consuming appropriate levels of these macronutrients. Several public health initiatives, including the *Dietary*

Guidelines for Americans and the NRC's *Diet and Health*, have recommended that these food components be monitored, and, in some cases, they have made specific recommendations about intake. *Dietary Guidelines for Americans*--published in 1980, revised in 1985, and reissued in 1990 and 1995--provides quantitative standards for total fat and saturated fat for all Americans age two or older. These recommendations are that individuals:

- Limit total fat to no more than 30 percent of total food energy
- Limit saturated fat to less than 10 percent of total food energy

In addition, NRC's *Diet and Health* recommends the following quantitative standards for sodium, cholesterol, carbohydrate and protein intake:

- Limit sodium intake to 2,400 mg or less per day
- Limit dietary cholesterol to 300 mg or less per day
- Carbohydrates should be more than 55 percent of food energy.
- Protein intake should be no more than twice the RDA.[14]

Finally, although *Diet and Health* makes no explicit recommendations for intake of dietary fiber, it does report a variety of sources that recommend that adults' intake of fiber be 20 to 35 grams per day. All the recommendations of *Dietary Guidelines* and *Diet and Health,*which were used as reference standards in this report and are referred to collectively here as the "dietary guidelines," are summarized in Table II.4.

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[14]The RDA for protein ranges from 13 grams for infants to 70 grams for 25- to 50-year-old males and 64 grams for 25- to 50-year-old females.

TABLE II.4

RECOMMENDED STANDARDS USED TO ASSESS DIETARY INTAKES

Dietary Component	Target
Total Fat	No more than 30 percent of total food energy
Saturated Fat	Less than 10 percent of total food energy
Carbohydrate	More than 55 percent of total food energy
Sodium	2,400 mg or less per day
Cholesterol	300 mg or less per day
Protein	Total protein intake of no more than twice the RDA
Fiber	At least 20 grams of fiber per day (for adults)

SOURCES: National Research Council, *Diet and Health; Dietary Guidelines for Americans*.

Estimating the Usual Intake Distribution. Most standards of dietary adequacy are defined in terms of "usual intake," which is the long-run average of daily intakes of a given nutrient for an individual. Intake of a nutrient by an individual, however, may vary considerably from one day to another. Because of the extent of day-to-day intake variability, estimates of a single day of dietary intake of a nutrient are not strongly correlated with the overall nutritional status of that individual with respect to that nutrient (Beaton et al. 1979; National Research Council 1986; and Beaton 1994). On any given day, some individuals in a randomly selected sample will have relatively high intakes of the nutrient, while others will have relatively low intakes; each of these intakes will be offset by lower or higher intakes on subsequent days. In sufficiently large samples, the highs and lows offset each other, and the mean usual nutrient intake can be estimated accurately with daily intake data. Thus, the mean daily intake of a nutrient across the CSFII sample is an unbiased estimate of the mean usual intake of that nutrient across the full population. However, the dispersion of a single-day intake around the group mean is larger than the dispersion of usual intake. Adding a second day of intake data and calculating the dispersion of individuals' two-day average intake around the group mean of the two-day average intake of the nutrient reduces the dispersion somewhat, but even this two-day mean dispersion is larger than the usual intake dispersion.

Because it would be very difficult to observe usual intake for an individual, it is necessary to develop an estimator of the distribution of usual intakes based on a sample of individuals with a small number of daily observations on each individual. The National Research Council (1986) proposed an empirical method of adjusting observed nutrient intakes to obtain unbiased estimates of the distribution of intakes that uses two days of intake information for each individual. This method estimates the intra-individual variation in nutrient intake and removes this source of variation before estimating the distribution of usual nutrient intake across the population. Nusser et al. (1996) developed methods for estimating the usual intake distribution that improved on the NRC methodology, which required strong assumptions about the normality of the distribution of daily intake.[15] In the descriptive analysis of this study, the method proposed by Nusser et al. (1996) was used to generate estimates of the usual intake distribution. These procedures were implemented using the Software for Intake Distribution Estimation (SIDE) program (Iowa State University 1996).[16]

Measuring Nutrient Intake by Food Source. Because food stamps must be used to purchase foods from certain types of food stores (but not from restaurants), one might expect the program to lead participants to obtain a larger proportion of their food from food stores. Alternatively, since food stamps lead to greater household resources, the effect of the program may be to free up resources for participants to eat out at restaurants more often. In either case, participation could influence the source from which participants obtain the food they eat.

Since CSFII data contain information on where foods were obtained, the effect of participation on this outcome was estimated. Using CSFII data, individuals' total daily nutrient intake was divided into the portion derived from foods individuals obtain from food stores, foods obtained from restaurants, and foods obtained from other sources (for example, foods respondents grew themselves

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[15]The method proposed by Nusser et al. (1996) accounts for the fact that daily intake data for individuals are nonnegative and often are highly skewed. This procedure also allows for survey weights in the estimation process and accounts for correlation in intake among survey days. The estimation procedure involves four steps. First, the original data are standardized by adjusting for nuisance effects such as day of week and interview sequence. Second, the daily intake data distribution is transformed to normality. Third, using a normal components of variance model, the distribution of usual intakes is constructed for the transformed data. Finally, the new usual intake distribution is transformed back to its original scale by reversing the procedures of step 2.

[16]This methodology and the SIDE software also make possible taking into account design effects when calculating standard errors of specific statistics based on the usual intake distribution (such as the percentage of the sample below 70 percent of the RDA).

and foods they received free from charitable organizations). Individuals' nutrient intake from each of these sources was measured in absolute terms, as well as relative to the percentage of their total intake.

b. Other Measures of Dietary Quality

To gain a broader picture of individuals' dietary quality, individuals' dietary behavior (as described earlier in this section), their consumption of specific food groups, and previously developed measures of overall diet quality were examined.

Because individuals choose foods rather than nutrients in planning their diets, any effects of food stamp benefits on dietary adequacy should initially come through effects on either the amounts or types of foods they consume. These food stamp effects on the foods consumed may or may not translate into effects on nutrient intake, but without influencing the amounts or types of foods consumed, food stamp benefits will not influence nutrient intake.[17]

Food consumption was measured using the food groups defined in the USDA Food Guide Pyramid--in particular, fruit, vegetables, grain products, dairy products, and meat and meat substitutes. Several subgroups within the meat food group, including red meat, poultry, fish, eggs, and nuts and seeds were also examined. Finally, consumption of the food components at the top of the pyramid, including alcoholic beverages, discretionary fat, and added sugar, was measured.

To measure individuals' overall diet quality, information on both nutrient intake and consumption of specific food groups was used to calculate two previously defined composite measures of diet quality: (1) the Healthy Eating Index (HEI), and (2) the Diet Quality Index (DQI).

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[17]It is possible, however, that food stamp benefits influence the amounts or types of foods consumed in ways that are difficult to measure. For example, if an increase in benefits led an individual to consume more corn and fewer peas, then intake of specific nutrients would be affected without a change in the individual's consumption of vegetables.

Developed by Kennedy et al. (1995), the HEI is based on 10 components having to do with different aspects of healthy eating:

- Components 1 through 5 measure the degree to which an individual's consumption of the major food groups (grain products, vegetables, fruits, dairy products, and meats) conforms to USDA Food Guide Pyramid recommendations.

- Component 6 measures the degree to which overall fat consumption as a percentage of food energy intake conforms with the *Dietary Guidelines* recommendation of no more than 30 percent.

- Component 7 measures the degree to which saturated fat consumption as a percentage of food energy intake conforms with the *Dietary Guidelines* recommendation of less than 10 percent.

- Component 8 measures the degree to which cholesterol intake conforms with the *Dietary Guidelines* recommendation of 300 mg or less.

- Component 9 measures the degree to which sodium intake conforms with the *Dietary Guidelines* recommendation of 2,400 mg or less.

- Component 10 is based on the extent of variety in a person's diet.

The HEI is defined as the sum of these 10 components; thus, it has a range of 0 to 100, with higher values indicating diets of higher quality.

The DQI was developed by Patterson et al. (1994) and has a similar structure to the HEI.[18] The DQI is the sum of eight components, each of which takes on values of either 0, 1, or 2, depending

[18]Since this analysis was conducted, the DQI was updated by Haines et al. (1999) and a methodology for generating a revised version of this index, the DQI-R, was developed. The revisions were implemented "to reflect current dietary guidance, to incorporate improved methods of estimating food servings, and to develop and incorporate measures of dietary variety and moderation." Given similarities between the original DQI and the updated DQI-R, it is unlikely that replacing the DQI used in this report with the DQI-R would have changed any of the conclusions of the analysis.

on the degree to which a person's diet *fails to* comply with specific dietary standards. The components of the DQI include:

- Whether the individual has total fat intake of 30 percent or less of food energy
- Whether the individual has saturated fat intake of less than 10 percent of food energy
- Whether the individual has cholesterol intake of 300 mg or less
- Whether the individual eats five or more servings of fruit or vegetables daily
- Whether the individual eats six or more servings of breads, cereals, and legumes
- Whether the individual limits protein intake to less than twice the RDA
- Whether the individual limits sodium intake to 2,400 mg or less
- Whether the individual has calcium intake at the RDA or higher

The DQI has a range of 0 to 16. Because each component has a score of 0 if the person meets the dietary standard, 1 if he or she does not meet the standard but is close to meeting it, and 2 if the person is not close to meeting the standard, *lower* values of the DQI indicate *higher* diet quality.

D. METHODOLOGICAL ISSUES

1. Basic Approach

This report presents the results of both univariate descriptive analysis and multivariate analysis. As already noted, the analysis was conducted separately for samples of low-income preschoolers, school-age children, and adults. The descriptive analysis consisted of calculating weighted means and frequencies of relevant measures of dietary knowledge and attitudes and of dietary adequacy. The multivariate analysis consisted of estimating ordinary least squares (OLS), logit, and tobit regressions designed to measure the effect of food stamp participation on dietary intake (see Section D.2).

In comparing various measures of dietary knowledge and attitudes in the descriptive analysis and in measuring the effects of food stamp participation on dietary intake in the multivariate analysis, tests of statistical significance were used to determine whether observed differences are statistically meaningful. These significance tests were two-tailed tests, and standard levels of statistical significance (1 percent and 5 percent) were used. The data were also examined for patterns of findings. Thus, the focus of the presentation was not necessarily on every statistically significant estimate if it was not part of a larger pattern of consistent findings. On the other hand, findings not necessarily statistically significant but consistent with general patterns of findings were noted.

One complication in conducting these statistical tests was that the samples being analyzed were not simple random samples. Instead, the samples were stratified, clustered, disproportionately representative of low-income individuals, and subject to nonresponse bias. As a result of this complex sampling design, the standard errors and resulting significance tests conducted by standard statistical software packages (which assume simple random sampling) may have been biased and may have overstated levels of statistical significance.[19] For all the significance tests in the descriptive analysis, a software package was used that takes into account these design factors in estimating standard errors and conducting significance tests; therefore, the resulting standard errors were unbiased and the significance tests accurate. In particular, the SUDAAN statistical package was used to estimate standard errors and conduct significance tests after adjusting for design effects (using a technique involving Taylor series expansions).

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[19]A complex sample design is most likely to bias standard error estimates in bivariate significance tests, where a simple mean or frequency among one group is compared with that of another group. In multivariate analysis, since comparisons between groups are made after controlling for a variety of other factors (including factors relating to the sample design), this is less likely to be a problem.

2. Estimating the Effects of FSP Participation on Dietary Adequacy

a. Basic Models

Various regression models were estimated to measure the effects of food stamps on dietary adequacy. The outcome measures of these models included the:

- Dietary behavior index
- Number of servings consumed from each of the five major food groups, along with consumption of added sugar, discretionary fat, and alcoholic beverages
- Intake of nutrients and other dietary components, in absolute terms and as a percentage of the RDA standards
- Binary indicators of whether specific dietary standards were met, including 70 percent of the RDA levels for vitamins and minerals, 100 percent of the REA for food energy, and the *Dietary Guidelines* for macronutrients and other dietary components described earlier
- Percentage of food energy consumed from store-bought foods, restaurant-bought foods, and other foods, as well as nutrient intake (in absolute terms or as a percentage of the RDA) from each of these food sources
- HEI and DQI

Models using a variety of regression techniques were estimated, depending on the form of the dependent variable. For all continuous variables, OLS regression models were estimated. For binary dependent variables such as the indicators of whether an individual met a particular dietary standard, logit models were estimated. Finally, the variables indicating the intake of nutrients from restaurant-bought foods and "other" foods were continuous, but censored at 0 (that is, these variables were equal to 0 for a large number of observations); for these dependent variables, tobit models were estimated.

The regression models were designed to measure the effect of food stamp benefits on food and nutrient intake while controlling for as wide a range of other relevant factors as possible. The measure of food stamp benefits was the per-capita benefit amount received by a household (the total benefit amount divided by the number of household members). Two key sets of factors the regressions included as control variables were (1) the economic conditions of individuals' households, and (2) individuals' dietary knowledge and attitudes (among adults). A large number of additional factors were controlled for, as shown in Table II.5.

The basic set of models did not control for potentially endogenous factors--that is, factors that may have been *affected by* nutrient intake rather than (or in addition to) *affecting* nutrient intake. The inclusion of the endogenous right-hand-side variable would have led to biased coefficient estimates. Two potentially endogenous sets of variables excluded were a set of binary variables indicating a person's body mass index (BMI) and the two dietary susceptibility factors, perceived micronutrient and macronutrient susceptibility.[20]

b. Estimation Issues

Misspecification. The basic models estimated in this study were unweighted regression models, and food stamp benefits were hypothesized to affect food and nutrient intake linearly. It is possible that this model was misspecified, leading to biased estimates of the effects of food stamp participation on intake. To account for this possibility, and to test for the robustness of the results, alternative versions of the model were estimated (the results of this robustness analysis are presented in Chapter V).

[20]For these variables, the argument for endogeneity is the following. Among individuals whose preferences lead them to consume large quantities of food, their higher intake levels are likely to lead to a higher BMI, greater perceived macronutrient susceptibility, and lower perceived micronutrient susceptibility. Thus, rather than BMI and perceived susceptibility influencing intake, the causality is reversed. To test the robustness of the results, alternative versions of the basic models were estimated, with these potentially endogenous variables added. It was found that the basic estimates of the effect of food stamp benefits on food and nutrient intake did not change substantially when these variables were added.

TABLE II.5

INDEPENDENT VARIABLES INCLUDED IN THE REGRESSION MODELS

Variable	Sample
Program Benefits	
Per-capita food stamp benefits	All
Per-capita AFDC benefits	All
Per-capita value of WIC benefits	All
Per-capita household value of NSLP benefits[a]	All
Per-capita household value of SBP benefits[a]	All
Participation in child care feeding program	Preschoolers only
Income and Assets	
Per-capita household income	All
Per-capita household income squared	All
Whether household holds at least $500 in cash assets	All
Whether someone in household owns the house	All
Demographic Characteristics (binary variables)	
Age=2	Preschoolers
Age=3	Preschoolers
Age=4	Preschoolers
Female	Preschoolers
Age=5 or 6	School-age children
Age=7 to 10	School-age children
Age=11 to 14 and female	School-age children
Age=15 to 18 and female	School-age children
Age=15 to 18 and male	School-age children
Age=19 to 24 and female	Adults
Age=19 to 24 and male	Adults
Age=25 to 50 and female	Adults
Age=51 to 64 and female	Adults
Age=51 to 64 and male	Adults
Age=65 or older and female	Adults
Age=65 or older and male	Adults
Pregnant or lactating female	Adults
Hispanic	All
Non-Hispanic black	All
Other racial/ethnic group (besides white, black, or Hispanic)	All
Midwest	All
South	All
West	All
Urban	All
Rural	All
Household Characteristics (binary variables)	
Adult(s) without children	Adults
Single adult with child(ren)	All
Multiple (nonmarried) adults with child(ren)	All
Household head is a high school dropout	Preschoolers and school-age children
Household head attended but did not complete college	Preschoolers and school-age children
Household head is a college graduate	Preschoolers and school-age children
Individual is a high school dropout	Adults
Individual attended but did not complete college	Adults
Individual is a college graduate	Adults

TABLE II.5 *(continued)*

Variable	Sample
Health-Related Variables (binary variables)	
Self-reported health = excellent	All
Self-reported health = very good	All
Self-reported health = fair or poor	Preschoolers and school-age children
Self-reported health = fair	Adults
Self-reported health = poor	Adults
Individual has ever had diabetes	Adults
Individual has ever had high blood pressure	Adults
Individual has ever had heart disease	Adults
Individual has ever had cancer	Adults
Individual has ever had osteoporosis	Adults
Individual has ever had high cholesterol	Adults
Individual has ever had a stroke	Adults
Individual exercises frequently (five to seven times a week)	Adults
Individual is a smoker	Adults
Individual takes vitamin supplements	All
Dietary Knowledge and Attitude Measures	
Diet-disease relation awareness factor	Adults
Knowledge of pyramid servings recommendations factor	Adults
Knowledge of foods' fat and cholesterol content factor	Adults
Nutrition importance factor	Adults
Belief in the diet-health relationship factor	Adults
DHKS respondent indicator	Adults
Other Variables	
Number of hours per day watched TV	All
Whether household usually shops for food once a month or less	All
Whether intake interviews took place in the winter	All
Whether intake interviews took place in the spring	All
Whether intake interviews took place in the fall	All
Whether intake interviews took place on the 1st through 10th of the month (on average)	All
Whether intake interviews took place on the 21st through 31st of the month (on average)	All
Survey year = 1995	All
Survey year = 1996	All

[a] The per-capita household value of SBP and NSLP benefits were calculated using the reported frequency of SBP/NSLP participation rates and certification status for free and reduced-price meals among all household members.

Although intake was specified as a linear function of food stamp benefits, one might imagine that food stamp benefits influence intake nonlinearly. In particular, low benefit levels may have little influence on food consumption, but higher benefit levels could lead to greater consumption. Although this type of nonlinearity is a possibility, it is difficult to test for nonlinear effects of food stamp benefits because benefits are determined by income and household size, which are controlled for in the model. Thus, after controlling for income and household size, there should be little variation in benefit levels among participants. The variation in benefit levels will be driven by the positive benefits among participants versus no benefits among nonparticipants.[21] As a result, if a nonlinear effect were estimated, we would not be sure whether this is truly a nonlinear effect of food stamp benefits or whether it reflects differences in the effects of benefits for households of different sizes and different incomes. For example, if the effect on intake of $100 in benefits is more than twice the size of the effect of $50 in benefits, this could be because of a nonlinearity, or it could be because the lower-income households who receive $100 in benefits react more strongly to benefits than do higher-income families who receive $50 in benefits.

Despite this difficulty in interpreting estimation results from a nonlinear model, two nonlinear forms of the basic model were estimated to determine whether the results were sensitive to the linearity assumption. In one case, food stamp benefits were modeled quadratically by adding a "benefits squared" term to the basic model. In another case, food stamp benefits were specified as a set of four dummy variables indicating participation and receipt of benefits in (1) the lowest quartile of the benefits distribution, (2) the second quartile, (3) the third quartile, and (4) the highest

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[21]Actually, variation in *per-capita* benefit levels will be driven almost entirely by variation in income, because per-capita benefit levels do not vary greatly for households of different sizes.

quartile.[22] As described below, to help with the interpretation of any nonlinear food stamp effects found, a model was also estimated that provided for a different effect of food stamp benefits among households with different income levels.

As already noted, there should be little or no variation in food stamp benefit levels among participants once income and household size are controlled for. However, because food stamp benefits actually are determined by net income (income minus certain deductions and expenses), and because some measurement error is likely to occur in the measures of income and household size, it is possible that there is variation in food stamp benefits among participants who report a certain household size and income level. Furthermore, food stamp participants with lower benefit levels than others with the same reported income and household size are likely to have a higher unobserved component of income. This unobserved component of income could, in turn, be correlated with income. Thus, measurement error in the income and household size variables could potentially lead to bias in the estimate of the effect of food stamp benefits on intake.

If, however, food stamp participation is measured as a binary variable that simply indicates whether an individual is a food stamp participant, this source of bias disappears. Because there is no attempt to measure which participants receive higher or lower benefit levels, the benefit level cannot be correlated with an unobserved component of income. The coefficient on the food stamp participation binary variable will measure the average effect of participation (and average level of benefits). In addition to the two nonlinear versions of the basic model described above, a version of the model was also estimated that measured food stamp participation with a single binary variable. If the results from estimation of this model were to differ greatly from the results of the basic model,

[22]Nonparticipants receiving no benefits were the excluded group in this set of dummy variables.

this would suggest the presence of the bias described above. If the results were to not differ greatly, however, this bias would be of less concern.

A second type of potential misspecification involves the use of sample weights. DuMouchel and Duncan (1983) noted that weighting can have a large impact on multivariate estimates if the sample stratifiers used to create the sample weights are not included in the model as explanatory variables. Devaney and Fraker (1989), using the 1977-1978 Nationwide Food Consumption Survey, showed that whether or not weights are used in a regression has a large effect on estimates of the effects of food stamp benefits on food expenditures.

The basic model in this study was estimated without using sample weights because the key factors used to construct the weights were included as control variables in the regression model. These sample stratifiers included sample members' age, sex, income level, region, urban/rural status, race, household structure, and day of the week and season of the year of the intake interview. However, because the weighting process was complicated, there was uncertainty about whether every relevant factor was being controlled for in the model. As a result, the robustness of the basic model was tested by estimating a weighted version of the model for several dependent variables.

Distributional Impacts of Food Stamp Benefits. As described earlier, a set of OLS models was estimated in which nutrient intake (for many nutrients measured as a percentage of the RDA) was hypothesized to depend on food stamp benefits and other factors. These models yield estimates of the effect of benefits on the mean intake levels of these nutrients. The models, however, tell us nothing about whether food stamp benefits influence any part of the nutrient intake distribution differently than they influence any other part. In particular, one might think that food stamp benefits are most effective in boosting intake of a nutrient among individuals whose intake would otherwise be deficient. By contrast, food stamp benefits may have little impact on intake of the nutrient for those who already consume a large amount of the nutrient. In other words, benefits may have a positive effect on intake in the lower part of the distribution, but no effect on intake in the upper part of the distribution.

To test for this possibility, a series of quantile regression models for selected nutrients was estimated.[23] Whereas OLS regression models yield estimates of the effects of independent variables on the mean value of the dependent variable, quantile regression models yield estimates of the effects of independent variables on a given percentile of the distribution. This percentile can be the median or any other percentile in the lower or upper half of the distribution. Quantile regression models were estimated for the 5th, 10th, 25th, 50th (median), 75th, and 90th percentiles.

Selection Bias. In several earlier studies of the effects of food stamp benefits on food expenditures, nutrient availability, and nutrient intake, researchers have noted the possibility that selection bias may influence the results. Typically, the argument is that food stamp participants may have different attitudes toward food or different knowledge of healthful dietary practices than nonparticipants. Assuming that dietary knowledge and attitudes are related to nutrient intake, a failure to control for these factors could lead to biased estimates of the effects of food stamp benefits on nutrient intake.

In addition to dietary knowledge and attitudes, other unobserved factors may be related to food stamp participation or benefits, leading to selection bias. For example, individuals whose economic situation is particularly bad, even though their reported income and assets are similar to others in the sample, may be more likely to apply for food stamps. Alternatively, those whose health conditions lead them to the Medicaid system may learn about and apply for food stamps through their contact

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[23]See Koenker and Bassett (1978) for a discussion of quantile regression models and their estimation.

with the Medicaid office, causing them to have higher food stamp participation rates than otherwise similar individuals without these health conditions.

The issue of selection bias was addressed by controlling, to the extent possible, for factors that affect nutrient intake and that may be correlated with food stamp participation or benefits. This approach was taken, rather than that of dealing with selection bias econometrically through selection-correction models, for two reasons. First, the CSFII/DHKS data set is a rich one, containing numerous relevant factors that potentially influence nutrient intake. As described earlier, the DHKS contains a great deal of information on individuals' dietary knowledge and attitudes. The CSFII has information on individuals' income and asset holdings, as well as characteristics related to a household's permanent income, such as the educational attainment of the individual or the household head (in the case of children). The CSFII also has information on individuals' self-assessment of their health and indicators of whether they have ever had various types of health problems.

Second, the econometric methods for correcting for selection bias, in practice, require that "identifying variables" be included in the model. In the context of modeling nutrient intake, identifying variables are factors that influence food stamp participation but that do not independently affect nutrient intake. These variables are difficult to find--most factors affecting whether a person receives food stamps could, arguably, be viewed as potentially affecting nutrient intake. In theory, some measure of individuals' ease in applying for food stamps or the degree to which they would feel stigmatized by using food stamps might be good candidates for identifying variables. Despite being a rich data set, however, the CSFII/DHKS does not contain these variables or any others that might be appropriate to use as identifying variables.

Subgroup Impacts. Food stamp benefits may affect the food consumption decisions of different groups of individuals differently. Among extremely low-income individuals, for example, the added financial resources of the benefits may have a different effect on nutrient intake than among those with relatively higher income. Even if the study results were to indicate that food stamp benefits do not significantly affect nutrient intake across the full low-income population, it would still be possible that benefits significantly affect intake for some subgroups of the population.

For this reason, the study tested whether food stamp benefits had different effects on nutrient intake for different subgroups of individuals. The approach taken was to interact food stamp benefits with the relevant variable or set of variables that define the subgroup of interest. For example, to assess whether effects vary by race/ethnicity, two dummy variables (whether a person was Hispanic or black, with white/other being the excluded group) were interacted with food stamp benefits. The significance levels of the two interaction terms indicate whether food stamp effects differ across the three racial/ethnic groups, and the coefficients of the model can be manipulated to calculate separate estimates of the effects of food stamp benefits on nutrient intake for each group.

Separate regression models were estimated for each set of subgroups tested. The following sets of subgroup characteristics were used: age and gender, race/ethnicity, income level, household structure, health status, National School Lunch Program and School Breakfast Program, diet-disease awareness, nutrition importance, survey year, family shopping patterns, and food security status of the family.

III. DIETARY KNOWLEDGE AND ATTITUDES OF LOW-INCOME ADULTS

The theoretical and empirical research on dietary knowledge and attitudes begins with the premise that individuals' knowledge of and attitudes toward nutrition affect the foods they eat. Another premise of the research is that nutrition education can influence individuals' dietary knowledge and attitudes. These premises, supported by empirical research, yield an important motivation for examining the dietary knowledge and attitudes of the low-income population.

Understanding the knowledge and attitudes of low-income adults will help us better understand the dietary status of this group in general, and of Food Stamp Program (FSP) participants in particular. For example, in what aspects of nutrition do low-income adults already have sufficient knowledge? In what areas could their nutrition knowledge be improved? Do the attitudes of these individuals suggest that they agree with, and are committed to following, established recommendations for healthful dietary practices? Because of the emphasis increasingly being placed on nutrition education in the FSP, it is especially important to more fully understand these issues among the low-income population generally and FSP participants in particular.

This chapter discusses the mean levels of dietary knowledge and attitudes of low-income adults, comparing them to the dietary knowledge and attitudes of adults with higher incomes. The chapter also compares the dietary knowledge of food stamp participants and low-income nonparticipants. As described in Chapter II, adults' dietary knowledge and attitudes are measured using composite variables based on items taken from the Diet and Health Knowledge Survey (DHKS). These composite variables include:

- Nutrition Knowledge Measures
    - Diet-Disease Relation Awareness Factor

- Pyramid Servings Recommendations Knowledge Factor
- Knowledge of Foods' Fat and Cholesterol Content Factor

• Dietary Beliefs Measure

  - Belief in the Diet-Health Relationship Factor

• General Dietary Attitudes Measure

  - Nutrition Important Factor

• Social-Psychological Attitudes Measures

  - Perceived Micronutrient Susceptibility Factor
  - Perceived Macronutrient Susceptibility Factor

A. NUTRITION KNOWLEDGE

Lower-income adults appear to possess lower levels of dietary knowledge than higher-income adults. They are less likely to know specific facts about the health problems associated with particular dietary practices, the U.S. Department of Agriculture's (USDA's) Food Guide Pyramid recommendations for food group consumption, and the fat/cholesterol content of particular foods. In contrast, the nutrition knowledge of food stamp participants and low-income nonparticipants are very similar. There are no significant differences between these groups in their nutrition knowledge factors.

Table III.1 shows the *diet-disease relation awareness factor,* along with its contributing items.[1] The mean value of the overall factor indicates that, of the seven diet-disease links examined in the

[1]The diet-disease relation awareness factor is based on DHKS items 5 and 6. Item 5 asks respondents whether they have heard of any health problems associated with particular dietary practices. If they say yes, item 6 asks them to list these health problems. If one of the health problems they list matches a health problem that has been documented in the literature to be associated with the dietary practice, respondents are considered to have correctly identified the health problem. If they say that they have not heard of any health problems associated with the dietary practice or if they do not list any of the relevant health problems for that dietary practice, respondents are considered to have incorrectly identified a primary health problem. Appendix A shows the health problems documented to be associated with particular dietary practices.

TABLE III.1

AWARENESS OF DIET-DISEASE RELATION AND PYRAMID SERVINGS RECOMMENDATIONS

	All		Low-Income	
	Low-Income	High-Income[a]	FSP Participants	Nonparticipants[a]
Diet-Disease Relation Awareness Factor (α=0.72)[b] [Factor Range: 0 to 7]	3.79	4.64**	3.84	3.77
Percentage Who Correctly Identify One of the Primary Health Problems Associated with:				
Eating too much fat	72	85**	70	72
Not eating enough fiber	40	63**	36	42
Eating too much salt or sodium	52	59**	58	50
Not eating enough calcium	62	77**	62	62
Eating too much cholesterol	69	83**	71	69
Eating too much sugar	10	13	10	10
Being overweight	75	86**	78	73
Pyramid Servings Recommendations Knowledge Factor (α=0.41)[c] [Factor Range: 0 to 5]	2.27	2.50**	2.23	2.29
Percentage Who Know the Recommended Number of Servings of:				
Fruit	70	73	69	70
Vegetables	44	53**	43	44
Dairy products	52	58	50	53
Grain products	4	7**	5	4
Meat	58	59	56	59
Sample Size	**1,464**	**4,194**	**435**	**1,029**

SOURCE: Weighted tabulations based on the 1994-1996 Diet and Health Knowledge Survey.

NOTE: The tests of statistical significance were conducted after taking into account design effects due to complex sampling and sample weights.

[a] Significance tests refer to the differences in the outcomes between high- and low-income individuals or between FSP participants and nonparticipants.

[b] Items included in the factor (and shown in this table) were determined by principal components analysis with promax rotation. The Diet-Disease Relation Awareness Factor is defined as the number (out of a maximum of seven) of dietary practices for which individuals can correctly identify the primary health problem associated with that practice. The value of Cronbach's alpha for low-income individuals is shown in parentheses.

[c] Items included in the factor (and shown in this table) were determined by principal components analysis with promax rotation. The Pyramid Servings Recommendations Knowledge Factor is defined as the number of food groups (out of a maximum of seven) in which individuals' estimates of the recommended number of servings falls within the actual recommended range. The value of Cronbach's alpha for low-income individuals is shown in parentheses.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

study, low-income adults can correctly identify just over half, or 3.79. High-income adults, by contrast, can correctly identify about two-thirds, or 4.64.

The contributing items show the same trends. Table III.1 shows that most low-income adults are able to name primary health problems associated with being overweight (75 percent), eating too much fat (72 percent), eating too much cholesterol (69 percent), and not eating enough calcium (63 percent). In addition, about half are able to name a primary health problem associated with eating too much salt or sodium (52 percent). On the other hand, only 40 percent can name a primary health problem associated with not eating enough fiber, and only 10 percent can name a primary health problem associated with eating too much sugar.

Adults with higher income levels are significantly more likely to be able to name a primary health problem associated with each of these dietary practices. The difference is particularly large with respect to fiber intake. While only 40 percent of low-income adults know that not eating enough fiber is associated with bowel problems, heart problems, and cancer, 63 percent of high-income adults can correctly identify one of these fiber-health problem links (Table III.1). Similarly, 83 percent of high-income versus 69 percent of low-income adults know that eating too much cholesterol is associated with high blood cholesterol or heart disease.

Among low-income adults, food stamp participants and nonparticipants have the same familiarity with the health problems associated with dietary practices. On average, each group can correctly identify a primary health problem for 3.8 out of 7 dietary practices (Table III.1), and there are no statistically significant differences in the proportion who can correctly identify a problem for any of the 7 practices.

The *pyramid servings recommendations knowledge factor* has a mean value of 2.27 out of 5 among low-income adults, indicating that this group can correctly identify just under half of these recommendations on average (Table III.1). They are most likely to be able to correctly identify the recommended number of fruit servings, as 70 percent correctly report that the recommended number is in the two-to four servings range. On the other hand, very few (four percent) know that they should consume an average of 6 to 11 servings of grain products each day.

High-income adults are somewhat more familiar with the pyramid servings recommendations, as their mean factor score indicates that they can correctly identify an average of 2.50 out of 5 (Table III.1). They are significantly more likely than low-income adults to correctly identify the recommended number of two of the five food groups--vegetables and grains. As with diet-disease relation knowledge, food stamp participants and nonparticipants do not significantly differ in their knowledge of the pyramid servings recommendations.

Knowledge of foods' fat and cholesterol content among low-income adults is mixed. The mean value of the fat/cholesterol knowledge factor indicates that low-income adults can answer an average of 55 percent of a set of 14 fat/cholesterol knowledge questions correctly (Table III.2). High-income adults, by contrast, can answer 65 percent correctly on average. In general, both groups can correctly choose between foods on the basis of which has more fat, although a larger proportion of the high-income group typically answer these questions correctly. Among low-income adults, for example, 89 percent know that whole milk has more fat than skim milk, 78 percent know that peanuts have more fat than popcorn, and 76 percent know that sour cream has more fat than yogurt. The corresponding percentages among high-income adults are 94, 88, and 86 percent. Each group is less likely to know more general concepts related to cholesterol and different types of fat. For example, only 17 percent of low-income and 29 percent of high-income adults know that "polyunsaturated fats are more likely than saturated fats to be liquid rather than solid." Similarly, 30 percent of low-

TABLE III.2

KNOWLEDGE OF FOODS' FAT AND CHOLESTEROL CONTENT

	All		Low-Income	
	Low-Income	High-Income[a]	FSP Participants	Nonparticipants[a]
Fat/Cholesterol Knowledge Factor (All Items) (α=0.60)[b] [Factor Range: 0 to 1]	0.55	0.65**	0.54	0.56
Percentage Who Know That:				
T-bone steak has more saturated fat than liver	62	62	66	60
Butter has more saturated fat than margarine	70	75**	67	71
Egg yolk has more saturated fat than egg white	68	83**	66	68
Whole milk has more saturated fat than skim milk	89	94**	89	88
Regular hamburger has more fat than ground round	69	81**	65	71
Pork spare ribs have more fat than loin pork chops	55	68**	52	56
Hot dogs have more fat than ham	47	64**	45	48
Peanuts have more fat than popcorn	78	88**	78	78
Sour cream has more fat than yogurt	76	86**	74	77
Porterhouse steak has more fat than round steak	37	51**	42	35
Polyunsaturated fats are more likely than saturated fats to be liquid rather than solid	17	29**	15	17
If a food has no cholesterol, it could be either low or high in saturated fat	43	55**	43	43
Cholesterol is found in animal products like meat and dairy products	30	37**	24	34**
Products labeled as containing only vegetable oil are low in saturated fat	34	35	28	36
Sample Size	**1,463**	**4,131**	**436**	**1,027**

SOURCE: Weighted tabulations based on the 1994-1996 Diet and Health Knowledge Survey.

NOTE: The tests of statistical significance were conducted after taking into account design effects due to complex sampling and sample weights.

[a] Significance tests refer to the differences in the outcomes between high- and low-income individuals or between FSP participants and nonparticipants.

[b] Items included in the factor (and shown in this table) were determined by principal components analysis with promax rotation. The Fat/Cholesterol Knowledge Factor is defined as the average score of the 14 items listed in the table, where individual responses were coded as 1 if the respondent had the correct answer, 0 if they responded incorrectly. The value of Cronbach's alpha for low-income individuals is shown in parentheses.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

income and 37 percent of high-income adults know that "cholesterol is found in animal products like meat and dairy products."

Again, participants and nonparticipants have similar levels of knowledge of foods' fat and cholesterol content. Participants differ significantly from nonparticipants in their knowledge on only 1 of 14 specific facts (that cholesterol is found in animal products like meat and dairy products).

B. DIETARY BELIEFS AND ATTITUDES

Low-income adults believe there is a relationship between the foods they eat and their health status. About 60 percent strongly agree that "what you eat can make a big difference in your chance of getting a disease," which is similar to the proportion of high-income adults with this belief (Table III.3). The *belief in the diet-health relationship factor*, measuring the degree to which individuals agree with this statement on a scale of 1 to 4 (with higher numbers indicating stronger agreement), has a mean of 3.42 in the low-income population, compared with 3.51 among high-income adults.

Corresponding to these beliefs, low-income adults also agree with the importance of following established recommendations for good nutrition. The *nutrition importance factor,* which indicates the importance individuals place on 11 of these guidelines, on a scale of 1 to 4, has a mean of 3.39 in the low-income population, the same as its mean value among high-income adults (Table III.3). For example, 72 percent of low-income adults feel that it is very important to eat a diet with plenty of fruit and vegetables, and 64 percent feel that it is very important to eat a diet low in fat. Overall, majorities of low-income adults feel it is very important to follow 9 of the 11 guidelines examined in this study. In addition, low-income adults are significantly more likely than high-income adults to feel that it is very important to follow 3 of the guidelines: choosing a diet with plenty of fruit and vegetables, choosing a diet low in fat, and eating at least two servings of dairy products daily.

TABLE III.3

INDIVIDUALS' BELIEF IN THE DIET-HEALTH RELATIONSHIP AND THE IMPORTANCE OF NUTRITION

	All		Low-Income	
	Low-Income	High-Income[a]	FSP Participants	Nonparticipants[a]
Belief in the Diet-Health Relationship Factor[b] [Factor Range: 1 to 4]	3.42	3.51**	3.46	3.40
Percentage Who Strongly Agree That:				
What you eat can make a big difference in your chance of getting a disease	60	61	60	60
Nutrition Importance Factor (α=0.85)[c] [Factor Range: 1 to 4]	3.39	3.39	3.35	3.40
Percentage Who Think It Is Very Important to:				
Use salt/sodium in moderation	56	51	51	58
Choose a diet low in saturated fat	58	54	56	59
Choose a diet with plenty of fruits/vegetables	72	67**	71	73
Use sugars only in moderation	52	51	51	53
Choose a diet with adequate fiber	51	51	46	54
Eat a variety of foods	60	62	56	61
Maintain a healthy weight	75	73	76	74
Choose a diet low in fat	64	57**	64	63
Choose a diet low in cholesterol	61	57	61	61
Choose a diet with plenty of grains	31	32	28	33
Eat at least two servings of dairy products daily	46	34**	47	45
Sample Size	**1,485**	**4,121**	**426**	**1,009**

SOURCE: Weighted tabulations based on the 1994-1996 Diet and Health Knowledge Survey.

NOTE: The tests of statistical significance were conducted after taking into account design effects due to complex sampling and sample weights.

[a] Significance tests refer to the differences in the outcomes between high- and low-income individuals or between FSP participants and nonparticipants.

[b] The Belief in the Diet-Health Relationship Factor is based on individuals' response to the question of the extent to which they agree with the statement listed in the table. Responses could range from 1 ("Strongly Disagree") to 4 ("Strongly Agree").

[c] Items included in the factor (and shown in this table) were determined by principal components analysis with promax rotation. The Nutrition Importance Factor is defined as the average score of individuals' responses to the items listed in the table. Individual responses could range from 1 ("Not at all important") to 4 ("Very important"). The value of Cronbach's alpha for low-income individuals is shown in parentheses.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

FSP participants and low-income nonparticipants have similar dietary beliefs and attitudes, as measured by belief in the diet-health relationship and nutrition importance factors. The same proportion of each group strongly agrees that “what you eat can make a big difference in your chance of getting a disease.” Furthermore, the difference between these groups in the mean value of the nutrition importance factor is not statistically significant. Similar proportions of participants and nonparticipants agree with the importance of following most of the dietary guidelines.

The two remaining measures of dietary attitudes--the *perceived micronutrient susceptibility factor* and the *perceived macronutrient susceptibility factor*--indicate individuals’ perceptions of their diet quality. Although these measures reflect dietary attitudes to some extent, they are also influenced by individuals’ dietary status. For example, those who report that their diets are too high in key macronutrients may do so because they have high standards regarding the quality of their diets (reflecting dietary attitudes) and/or because their actual intake of macronutrients (such as fat and cholesterol) is high. Thus, caution should be exercised in interpreting levels of perceived susceptibility and differences in these levels across groups.

Low-income adults are likely to believe their diets inadequate in some respect. On average, just under one of every three low-income adults feel their diets are too high or too low in each of the nutrients examined, as indicated by the perceived micronutrient susceptibility factor of 0.29 and the perceived macronutrient susceptibility factor of 0.32 (Table III.4). In particular, 36 percent believe that their diets are too low in calcium, 36 percent that their diets are too low in fiber, and 34 percent that their diets are too low in iron. Overall, nearly two-thirds believe that their diets are too low in at least one of the five micronutrients examined (not shown). Conversely, 43 percent believe that their diets are too high in fat, 34 percent that their diets are too high in saturated fat, 33 percent that their diets are too high in sugar and sweets, and 32 percent that their diets are too high

TABLE III.4

PERCEIVED SUSCEPTIBILITY

	All		Low-Income	
	Low-Income	High-Income[a]	FSP Participants	Nonparticipants[a]
Perceived Micronutrient Susceptibility Factor (α=0.55)[b] [Factor Range: 0 to 1]	0.29	0.29	0.34	0.27**
Percentage Who Believe Their Diets Are Too Low in:				
Calcium	36	37	37	36
Iron	34	30	37	33
Vitamin C	25	30**	31	23
Protein	15	12	17	14
Fiber	36	34	47	31**
Perceived Macronutrient Susceptibility Factor (α=0.73)[c] [Factor Range: 0 to 1]	0.32	0.38**	0.37	0.29**
Percentage Who Believe Their Diets Are Too High in:				
Calories	32	42**	36	30
Fat	43	50**	50	39*
Saturated fat	34	41**	38	32
Cholesterol	29	33	35	26*
Salt or sodium	22	25	24	21
Sugar and sweets	33	35	41	29
Sample Size	**1,430**	**4,161**	**427**	**1,003**

SOURCE: Weighted tabulations based on the 1994-1996 Diet and Health Knowledge Survey.

NOTE: The tests of statistical significance were conducted after taking into account design effects due to complex sampling and sample weights.

[a] Significance tests refer to the differences in the outcomes between high- and low-income individuals or between FSP participants and nonparticipants.

[b] Items included in the factor (and shown in this table) were determined by principal components analysis with promax rotation. The Perceived Micronutrient Susceptibility Factor is the mean of the five items listed above the factor, where each item is defined as 1 if the individual believes his or her diet is too low in a particular micronutrient, and equal to 0 otherwise. The value of Cronbach's alpha for low-income individuals is shown in parentheses.

[c] Items included in the factor (and shown in this table) were determined by principal components analysis with promax rotation. The Perceived Macronutrient Susceptibility Factor is the mean of the six items listed above the factor, where each item is defined as 1 if the individual believes his or her diet is too high in a particular macronutrient, and equal to 0 otherwise. The value of Cronbach's alpha for low-income individuals is shown in parentheses.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

in calories. Overall, two-thirds of sample members reported that their diets are too high in at least one of the six macronutrients examined (not shown).

Low-income adults are just as likely as high-income adults to believe their diets are too low in key micronutrients but are less likely to believe their diets are too high in key macronutrients (Table III.4). In particular, the mean micronutrient susceptibility factor is 0.29 for both groups, while the mean macronutrient susceptibility factor is 0.32 among low-income adults and 0.38 among high-income adults. As noted earlier, we must be careful in interpreting this difference, since it is consistent either with low-income and high-income adults having different attitudes about their consumption or having different consumption levels.

Differences in the perceived susceptibility of participants and nonparticipants are more striking. Participants are significantly more likely than nonparticipants to think both that their diets are too low in micronutrients and too high in macronutrients. As a result, the means of both susceptibility factors are substantially (and significantly) higher among participants than nonparticipants. For example, nearly half of participants feel their diets are too low in fiber compared with less than a third of nonparticipants, 50 percent of participants feel their diets are too high in fat compared with 39 percent of nonparticipants, 41 percent of participants feel their diets are too high in sugar and sweets compared with 29 percent of nonparticipants, and 35 percent of participants feel their diets are too high in cholesterol compared with 26 percent of nonparticipants.

Given the magnitude of these participant/nonparticipant differences in perceived susceptibility, the extent to which the differences might be explained by dietary status versus dietary attitudes was explored. In particular, the characteristics of FSP participants and low-income nonparticipants were examined, focusing particularly on characteristics related to health and weight (see Appendix Table B.1). This analysis showed that FSP participants are more likely than nonparticipants to be overweight, to report their health status as fair or poor, and to smoke. For example, 58 percent of participants report that they are overweight, compared with only 38 percent of low-income nonparticipants; differences in BMI (based on self-reported height and weight) are consistent with these self-perceptions.[2] Differences between the groups in self-reported health status and smoking status are similarly large. There are no large differences in exercise levels between participants and low-income nonparticipants.

These differences between participants and low-income nonparticipants suggest that the difference between the groups in perceived susceptibility may arise in part because of real differences in weight and health status, rather than dietary attitudes. However, it does not appear that the differences in weight/health conditions entirely explain participants' higher levels of perceived susceptibility--for two reasons. First, while higher weight levels might explain why participants think their diets too high in certain nutrients, they would not explain why they think their diets are low in other nutrients. Second, even after individuals' weight is controlled for, FSP participants have higher levels of perceived micronutrient and macronutrient susceptibility than do nonparticipants (Appendix Table B.2). Thus, it appears that observed differences in perceived susceptibility reflect some difference in dietary attitudes between participants and nonparticipants, in addition to reflecting some difference in weight/health.

[2]This difference between participants and nonparticipants in weight status occurs primarily among women, as the difference among males in the two groups is small. Among females, however, the difference is statistically significant and remains so even after controlling for income, race/ethnicity, age, and educational attainment.

IV. THE DIETARY ADEQUACY/QUALITY OF THE LOW-INCOME POPULATION

An important aspect of nutrition policy involves the adequacy and quality of the diets of low-income people. In particular, do low-income individuals consume sufficient amounts of food energy and key vitamins and minerals? Do they overconsume certain dietary components (such as fat, cholesterol, or sodium)? What are their dietary habits with respect to selecting and preparing specific foods? These questions motivate the descriptive analysis presented in this chapter on the dietary adequacy and quality of low-income people in the United States.

The analysis examines individuals' dietary habits as they relate to the intake of fat and cholesterol, the number of servings of major food groups consumed, and the intake of food energy, vitamins and minerals, key macronutrients, and other dietary components. While the focus of the analysis is on the low-income population, the intake levels of those with higher income are also examined to provide a benchmark for the low-income group. Furthermore, the analysis distinguishes between preschoolers, school-age children, and adults. The chapter does not discuss intake differences between Food Stamp Program (FSP) participants and low-income nonparticipants. Instead, Chapter V examines the effects of FSP participation on food and nutrient intake in detail.[1]

The chapter focuses on two broad measures of dietary outcomes: (1) dietary habits and food group consumption (outcomes that directly reflect the dietary choices of low-income individuals), and (2) the intake of nutrients and other dietary components (outcomes that are a result of the dietary choices individuals make). In the first category, the dietary habits measure differs from the food group consumption measure in one important respect: low-income individuals' dietary habits are

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[1]However, food and nutrient intake levels are presented separately by FSP participation status in Appendix C.

based on their responses to questions about what they "usually" do, while their food group consumption (and food and nutrient intake) is based on their reports of what they consumed on two specific days on which intake data were collected as part of the Continuing Survey of Food Intakes by Individuals (CSFII). With respect to food and nutrient intake, these two days of information must be used to draw inferences about what foods and nutrients low-income individuals usually consume.[2]

A. DIETARY BEHAVIOR AND FOOD GROUP CONSUMPTION

Two measures of individuals' dietary status reflect their primary dietary choices: (1) the foods they eat, and (2) their habits related to the ways in which these foods are prepared and served. This section first examines individuals' usual dietary behavior toward fat and cholesterol and then examines their intake of the major food groups (vegetables, fruits, meat and meat substitutes, dairy products, and grain products).

1. Dietary Behavior Toward Fat and Cholesterol

Kristal et al. (1990) developed a set of indexes to measure individuals' patterns of dietary behavior associated with consuming foods low in fat and cholesterol. Specifically, they created five indexes to measure the following tendencies of individuals to: (1) avoid fat as seasoning, (2) avoid meat, (3) modify high-fat foods, (4) substitute specially manufactured low-fat foods for high-fat foods, and (5) replace high-fat foods with other low-fat foods. The authors found that the items making up these indexes are reliable and that the indexes are strongly (and negatively) correlated with the consumption of fat.

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[2]Another difference between the dietary habit information and the food and nutrient intake information is that the former is drawn from the Diet and Health Knowledge Survey (DHKS) and thus is available only for adults, whereas the latter is drawn from the CSFII and is available for all age groups.

The DHKS contains a set of items similar to those used in the Kristal indexes. This study constructs a single index that contains all these items and that represents dietary behavior toward fat and cholesterol in general.[3] Table IV.1 contains the mean values of this index and its contributing items. The contributing items are grouped into four categories corresponding roughly to four of the five Kristal indexes: (1) modifying meat, (2) avoiding fat as seasoning, (3) substituting specially manufactured lower-fat foods for high-fat foods, and (4) replacing high-fat foods with other low-fat ones.

Low-income adults engage in dietary practices that, to a limited extent, help reduce the levels of fat and cholesterol in their diets, but they could do so to a much greater extent. The dietary behavior factor has a mean value of 2.60 on a scale of 1 to 4 in the low-income population, where 1 indicates that the individual never engages in a positive dietary practice (or always engages in a negative practice) and 4 indicates that the individual always engages in a positive dietary practice (or never engages in a negative practice).

The most common positive dietary practices among low-income adults include always trimming the fat from red meat (66 percent of low-income adults report doing this), infrequently eating chips (51 percent), always removing the skin from chicken (41 percent), never using cheese or creamy sauce on cooked vegetables (38 percent), and infrequently eating bakery products (38 percent). Only a small fraction report that they are likely to eat meat at a main meal less than once a week (13 percent), always eat low-fat cheese when eating cheese (11 percent), usually do not spread butter or margarine on breads and muffins (14 percent), or never eat *fried* chicken when eating chicken (11 percent).

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[3]Appendix A describes the motivation for creating a single dietary behavior index, rather than creating separate subindexes.

TABLE IV.1

MEASURES OF DIETARY BEHAVIOR[a]

	Low-Income Adults	High-Income Adults[b]
Modifying Meat (Percentage Who):		
When eating chicken, never eat it fried	11	17**
When eating chicken, always remove the skin	41	47*
When eating red meat, usually eat small portions	32	32
When eating red meat, always trim the fat	66	71*
Avoiding Fat as Seasoning (Percentage Who):		
Never put butter or margarine on cooked vegetables	25	18**
Always eat boiled or baked potatoes without butter or margarine	13	7**
Never put cheese or another creamy sauce on cooked vegetables	38	28**
Usually spread no butter or margarine on breads and muffins	14	10**
Substitution (Percentage Who):		
Always eat fish or poultry instead of red meat	18	17
Always use skim or one percent milk instead of two percent or whole milk	23	39**
Always eat special, low-fat cheeses when eating cheese	11	15**
Always eat ice milk, frozen yogurt, or sherbet instead of ice cream	15	18
Always use low-calorie instead of regular salad dressing	22	29**
Always eat low-fat luncheon meats instead of regular luncheon meat	17	26**
Replacement (Percentage Who):		
Eat meat at main meal less than once a week	13	14
Always have fruit for dessert when eating dessert	19	14**
Eat chips, such as corn or potato chips, less than once a week	51	45**
Eat bakery products (cakes, cookies, donuts) less than once a week	38	35
Eat less than one egg a week	25	33**
Dietary Behavior Factor (α=0.77)[c] [Factor Range: 1 to 4]	2.60	2.74**
Sample Size	**1,466**	**4,134**

SOURCE: Weighted tabulations based on the 1994-1996 Diet and Health Knowledge Survey.

[a] These categories of dietary behavior are based on indexes suggested by Kristal et al. (1990).

[b] Significance test refers to difference in the outcome among high-income and low-income adults. Low income is defined as household income less than 130 percent of the poverty line. High income is defined as household income higher than 130 percent of the poverty line.

[c] The Dietary Behavior Factor is the average score of the 19 items listed in the table. This factor is measured on a 1 to 4 scale, with higher values representing more nutritious dietary behavior. The value of Cronbach's alpha for low-income adults is shown in parentheses.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Low-income individuals are also less likely than those with higher income to engage in healthy dietary behaviors. Overall, the dietary behavior factor has a mean value of 2.60 for low-income adults and 2.74 among high-income adults (a difference that is statistically significant). In particular, only 11 percent of low-income adults who eat chicken never eat it fried, compared to 17 percent of high-income adults who never eat chicken fried while eating chicken. Similarly, 23 percent of the low-income group always drink low-fat milk, compared with 39 percent of the high-income group. In addition, high-income adults are more likely to eat less than one egg a week. On the other hand, low-income adults are more likely to avoid fat as seasoning. For example, they are more likely than high-income adults to never put butter, margarine, cheese, or another creamy sauce on cooked vegetables or boiled or baked potatoes. They are also more likely to eat fruit for dessert when eating dessert and eat chips less than once a week.

2. Food Group Consumption

The U.S. Department of Agriculture (USDA) Food Guide Pyramid recommends that individuals over two years of age consume specific numbers of servings of the five major food groups. These pyramid servings fall into the following ranges:

- Grain products: 6 to 11 servings
- Vegetables: 3 to 5 servings
- Fruit: 2 to 4 servings
- Milk: 2 to 3 servings
- Meat and meat substitutes: 2 to 3 servings

The CSFII contains information on the number of servings from each food group, along with some other types of food, consumed by each CSFII respondent on the two intake days. The number of servings each respondent consumed was averaged over the two days, along with the consumption from each food group by preschoolers, school-age children, and adults (Table IV.2). The other food types reported in the table include the component parts of the meat group (red meat, poultry, fish, eggs, and nuts and seeds), discretionary fat, added sugar, and alcoholic drinks.

Low-income individuals frequently do not consume the recommended number of servings from these food groups.[4] Among adults, for example, 41 percent consume less than two servings of meat or meat substitutes, 51 percent consume less than six servings of grain products, 46 percent consume less than three servings of vegetables, and 71 percent less than two servings of both fruit and dairy products.

In addition, low-income preschoolers and school-age children frequently consume less than the recommended number of servings of these foods, although their consumption patterns differ from those of low-income adults. Children tend to consume a greater number of servings of fruit and dairy products than adults but fewer servings of vegetables and meat products. For example, whereas preschoolers and school-age children, on average, consume 1.8 and 1.9 servings of dairy products, adults consume only 1.2 servings. Conversely, preschoolers and school-age children

High-income individuals also often consume less than the recommended number of servings from the major food groups, but their consumption of servings of all food groups except for meat and meat substitutes tends to be higher than that of low-income individuals. Among adults, for consume 2.4 and 2.8 servings of vegetables, while adults consume 3.2 servings. For instance, 46 percent of low-income individuals consume less than three servings of vegetables, compared to 33

[4]The distribution of food group servings consumption is measured over two days, rather than the distribution of *usual* food group servings consumption. Because the distribution of two-day consumption is likely to vary more widely than the distribution of usual consumption, the estimate of the proportion of individuals whose usual intake meets the food group servings targets may be biased.

TABLE IV.2

FOOD GROUP INTAKE

Number of Servings	Preschoolers (Ages 2 to 4) Low-Income	Preschoolers (Ages 2 to 4) High-Income[a]	School-Age Children Low-Income	School-Age Children High-Income[a]	Adults Low-Income	Adults High-Income[a]
Grain Products (Percentages)						
0 to 5	47	40	39	30	51	41
6 to 11[b]	**50**	**59**	**55**	**61**	**40**	**51**
More than 11	3	2	6	9	8	8
(Mean)	6.0	6.2	6.8	7.3**	6.3	6.7*
Vegetables (Percentages)						
0 to 2	60	68	51	55	46	33
3 to 5[b]	**37**	**30**	**41**	**37**	**41**	**49**
More than 5	3	2	9	8	13	18
(Mean)	2.4	2**	2.8	2.7	3.2	3.7**
Fruit (Percentages)						
0 to 1	48	35	66	62	71	62
2 to 4[b]	**44**	**51**	**30**	**32**	**24**	**32**
More than 4	8	14	4	6	5	7
(Mean)	1.9	2.5**	1.3	1.5	1.2	1.5**
Dairy Products (Percentages)						
0 to 1	44	40	41	39	71	65
2 to 3[b]	**50**	**52**	**51**	**48**	**24**	**30**
More than 3	6	8	9	13	5	5
(Mean)	1.8	1.9	1.9	2.1*	1.2	1.4**
Meat and Meat Substitutes (Percentages)						
0 to 1	72	86	47	58	41	39
2 to 3[b]	**27**	**14**	**46**	**37**	**48**	**49**
More than 3	1	0	7	4	11	11
(Mean)	1.2	0.9**	1.8	1.5**	2.0	2.0
Servings of Red Meat (Mean)	0.69	0.51**	1.06	0.91**	1.12	1.11
Servings of Poultry (Mean)	0.30	0.23*	0.40	0.37	0.47	0.51
Servings of Fish (Mean)	0.05	0.05	0.10	0.09	0.16	0.19
Number of Eggs (Mean)	0.14	0.09**	0.16	0.09**	0.20	0.15**
Servings of Nuts and Seeds (Mean)	0.05	0.06	0.04	0.07**	0.04	0.06*
Grams of Discretionary Fat (Mean)	43.4	40.4*	57.8	58.0	53.0	57.0*
Teaspoons of Added Sugar (Mean)	12.8	14.8**	22.5	26**	18.2	18.8
Number of Alcoholic Drinks (Mean)	--	--	0.1	0.0	0.4	0.5
Sample Size	**571**	**1,057**	**926**	**2,198**	**2,224**	**7,161**

TABLE IV.2 *(continued)*

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

[a] Significance test refers to difference in the outcome among high-income and low-income groups. Low income is defined as household income less than 130 percent of the poverty line. High income is defined as household income higher than 130 percent of the poverty line.

[b] USDA servings recommendations are in bold.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

percent of high-income individuals. Similarly, 71 percent of low-income adults consume less than two servings of fruit, compared with 62 percent of high-income adults. Consumption of food group servings followed a different pattern for preschoolers where, on average, high-income preschoolers consume fewer servings of vegetables and meat or meat substitutes and more servings of fruit than low-income preschoolers.

B. NUTRIENT INTAKE

Two types of measures were used to characterize the dietary adequacy and quality of low-income individuals. First, mean levels of nutrient intake among low-income individuals were examined for key micronutrients and macronutrients. Second, because mean intake levels do not always present a complete picture of the extent to which individuals in a group may be over- or underconsuming nutrients, the percentage of sample members whose usual consumption of nutrients meets recommended guidelines was also examined. This section presents these two types of measures to describe low-income individuals' intake of food energy, protein, and key micronutrients, followed by similar measures to describe their intake of macronutrients and other dietary components.

1. Food Energy, Protein, and Key Micronutrients

On average, low-income people in the United States consume amounts of most vitamins and minerals that are well above the recommended levels. In particular, mean intake of key vitamins and minerals exceeds 100 percent of the Recommended Dietary Allowance (RDA), with a few exceptions (Table IV.3). Intake levels among preschoolers are particularly high. For example,

TABLE IV.3

NUTRIENT INTAKE LEVELS AS A PERCENTAGE OF THE RDA

	Preschoolers		School-Age Children		Adults	
	Low-Income	High-Income[a]	Low-Income	High-Income[a]	Low-Income	High-Income[a]
Macronutrients						
Food Energy	101	98	90	92	79	83*
Protein	303	276**	203	192*	139	138
Vitamins						
Vitamin A	169	176	114	120	100	113**
Vitamin C	228	227	195	195	137	160*
Vitamin E	79	77	83	89*	77	92**
Vitamin B_6	131	126	113	117	88	100**
Vitamin B_{12}	482	411	321	265*	278	252
Niacin	148	139	135	141	130	143**
Thiamin	161	156	143	149	119	129**
Riboflavin	198	192	151	157	120	130**
Folate	359	337*	200	208	120	134**
Minerals						
Calcium	99	101	88	94*	79	91**
Iron	116	110	125	133*	122	140**
Magnesium	211	211	110	112	79	87**
Phosphorus	122	119	123	126	131	148**
Zinc	81	74**	91	92	79	83
Sample Size	**785**	**1,483**	**926**	**2,198**	**2,224**	**7,161**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: Intake levels are measured as a percentage of the RDA values for all nutrients.

[a] Significance test refers to difference in the outcome among high-income and low-income groups. Low income is defined as household income less than 130 percent of the poverty line. High income is defined as household income higher than 130 percent of the poverty line.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

among 11 key nutrients identified as potentially problematic from a public health perspective, mean intake levels for low-income preschoolers are below 100 percent of the RDA for only two: vitamin E (79 percent of the RDA) and zinc (81 percent of the RDA).[5] For the remaining key vitamins and minerals, intake among preschoolers is well above the RDA level. However, mean intake levels at or above the RDA do not guarantee that all individuals within the group have sufficiently high intake levels to meet their nutrient requirements. The question of the proportion of individuals whose intake is likely to be inadequate is addressed later in this chapter when we examine percentages of individuals meeting certain specified dietary guidelines.

Mean intake levels of vitamins and minerals among low-income, school-age children are somewhat lower than those among low-income preschoolers, but the intake levels for the two groups show a similar pattern. Among the 11 key vitamins and minerals, mean intake is less than the RDA standard for vitamin E (83 percent), calcium (88 percent), and zinc (91 percent). Among low-income adults, intake of key vitamins and minerals is lower still, but mean intake levels are at or above the RDA standard for many nutrients. Low-income adults' mean intake levels of vitamin E (77 percent), vitamin B_6 (88 percent), calcium (79 percent), magnesium (79 percent), and zinc (79 percent) fail to meet the RDA standard. However, low-income adults' mean intake of the remaining vitamins and minerals is at or above the RDA standards.

The CSFII also contains information on the food energy intake of low-income individuals. There is convincing evidence, however, that food energy intake is underreported in dietary recall

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[5]According to the 1995 *Third Report on Nutrition Monitoring in the United States* (Life Sciences Research Office 1995), intake of the following 11 nutrients (among those examined in this report) is a current or potential future public health issue: vitamin A, vitamin C, vitamin E, vitamin B_6, vitamin B_{12}, folate, calcium, iron, magnesium, phosphorus, and zinc.

studies.[6] These studies use a variety of methodologies to document this underreporting, while also showing that it is most prevalent among females and those who are overweight (Bandini et al. 1990; Black et al. 1993; Licktman et al. 1992; Mertz et al. 1991; and Briefel et al. 1995).[7] Consequently, nutrient intake estimates from dietary recall studies represent a lower limit of actual intake, and average energy levels below 100 percent of the Recommended Energy Allowance (REA) are not necessarily a cause for concern (Lin et al. 1996).[8]

Low-income preschoolers reported food energy intake levels that meet the REA almost exactly. On average, preschoolers consume 101 percent of the REA. On the other hand, mean food energy intake levels among low-income, school-age children and adults are lower than the REA. In particular, the mean reported level of energy intake is 90 percent of the REA among low-income, school-age children and 79 percent of the REA among adults. Because the REA is set at the energy needs of the average person, rather than an amount sufficient to meet the needs of most people, an intake level below the REA suggests that some low-income, school-age children and adults are not consuming enough food energy. Given underreporting of food energy intake, however, the actual mean intake levels of school-age children and adults will likely be closer to recommended levels.

Mean nutrient intake levels of energy, vitamins and minerals for low-income adults are significantly lower than those for high-income adults. For instance, mean intake levels for high-

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[6]In addition, underreporting of food energy likely translates into some underreporting of vitamin and mineral intake. However, not much is known about underreporting of the intake of individual vitamins and minerals.

[7]In their nutrition study, Mertz et al. (1991) found that volunteers underreported caloric intakes by 18 percent, on average. The degree of underreporting likely varies in different surveys, but there is no available research on underreporting in the 1994-1996 CSFII.

[8]No evidence exists on whether underreporting is more common among FSP participants or low-income nonparticipants, except that underreporting is known to be more common among those who are overweight and that participants are more likely to be overweight (see Appendix B).

income adults were higher for 12 of 14 vitamins and minerals, compared to mean intake levels for low-income levels. Such patterns of differences are not observed for low- and high-income preschoolers and school-age children.

Despite the fact that mean intake levels of several vitamins and minerals among low-income individuals generally exceed the RDA, usual intake levels for several key nutrients and food energy are lower than the recommended levels for substantial numbers of these individuals.[9] Table IV.4 shows the percentages of the low-income population whose intake levels exceed 70 and 100 percent of the RDA standards for food energy and a variety of vitamins and minerals. The discussion of usual intake focuses primarily on the 70 percent standard (except for food energy), because the percentage below 70 percent of the RDA is a more reliable indicator than the percentage below 100 percent of the RDA of the incidence of nutrient inadequacy in the low-income population.

Low-income preschoolers are likely to meet the 70 percent of the RDA standard for most vitamins and minerals. Among the 11 key vitamins and minerals cited earlier, more than 90 percent of preschoolers meet this standard for all but four: vitamin E, calcium, iron, and zinc. For this group, consumption of vitamin E and zinc is least likely to exceed 70 percent of the RDA. Only 58 percent of low-income preschoolers have vitamin E intake exceeding 70 percent of the RDA and 66 percent have zinc intake meeting this standard. However, nearly all (96 percent or higher) low-

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[9]As described in Chapter II, individuals' usual intake of nutrients is measured based on two days of nutrient intake data. To adjust for individuals' day-to-day variation in their nutrient intake, the Software for Intake Distribution Estimation (SIDE) statistical software was used. Not taking into account this intra-individual variation leads to bias in the estimate of the proportion of individuals who exceed a certain proportion of the RDA. For comparison, estimates are provided of the percentage of sample members who exceed 70 and 100 percent of the RDA, based on their average two-day intakes (Appendix Table C.6). We find that, for most nutrients, a considerably smaller proportion of individuals meet the target guideline according to the two-day average intake measure than according to the usual intake measure.

TABLE IV.4

PERCENTAGE OF INDIVIDUALS WHOSE USUAL NUTRIENT INTAKE MEETS RECOMMENDED THRESHOLDS

	Preschoolers		School-Age Children		Adults	
	Low-Income	High-Income[a]	Low-Income	High-Income[a]	Low-Income	High-Income[a]
Macronutrients						
Food Energy						
100 percent of REA[b]	49	44	35	35	21	23**
Protein						
70 percent of RDA	100	100	100	100	96	98**
100 percent of RDA	100	100	98	96	78	85**
Vitamins						
Vitamin A						
70 percent of RDA	98	99	79	85	62	77**
100 percent of RDA	88	93	51	60	38	52**
Vitamin C						
70 percent of RDA	99	98	97	95	84	86
100 percent of RDA	94	92	89	86	68	71
Vitamin E						
70 percent of RDA	58	56	80	75	58	72**
100 percent of RDA	19	17	23	30	25	37**
Vitamin B_6						
70 percent of RDA	95	98*	92	93	73	82**
100 percent of RDA	76	78	64	68	37	47**
Vitamin B_{12}						
70 percent of RDA	100	100	100	99*	97	99*
100 percent of RDA	100	100	99	98*	89	94**
Niacin						
70 percent of RDA	96	98	98	99	95	98**
100 percent of RDA	84	83	85	87	76	86**
Thiamin						
70 percent of RDA	99	100	99	99	93	96*
100 percent of RDA	93	94	90	89	69	76**
Riboflavin						
70 percent of RDA	100	100	99	98	90	95**
100 percent of RDA	98	97	90	90	65	75**

TABLE IV.4 *(continued)*

	Preschoolers		School-Age Children		Adults	
	Low-Income	High-Income[a]	Low-Income	High-Income[a]	Low-Income	High-Income[a]
Folate						
70 percent of RDA	100	100	98	98	87	91**
100 percent of RDA	100	100	91	91	62	71**
Minerals						
Calcium						
70 percent of RDA	81	83	71	74	54	68**
100 percent of RDA	48	49	35	41	25	36**
Iron						
70 percent of RDA	88	90	94	94	82	90**
100 percent of RDA	60	57	73	74	59	71**
Magnesium						
70 percent of RDA	100	100	84	83	61	74**
100 percent of RDA	98	99	56	57	22	30**
Phosphorus						
70 percent of RDA	96	96	96	95	92	97**
100 percent of RDA	75	73	76	75	72	84**
Zinc						
70 percent of RDA	66	56*	82	80	57	65**
100 percent of RDA	22	11**	36	36	19	24*
Sample Size	**785**	**1,483**	**926**	**2,198**	**2,224**	**7,161**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: Usual intake calculations were made using two days of individuals' intake information after correcting for intra-individual variation using the SIDE statistical software.

[a] Significance test refers to difference in the outcome among high-income and low-income groups. Low income is defined as household income less than 130 percent of the poverty line. High income is defined as household income higher than 130 percent of the poverty line.

[b] The REA for food energy represents an amount necessary to meet the requirements of the average individual in a particular group. If all individuals were meeting their energy requirement exactly, we would expect half to have energy intakes above the REA and half below the REA.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

income preschoolers meet 70 percent of the RDA for vitamin A, vitamin C, vitamin B_{12}, magnesium, and phosphorus.

About half of all low-income preschoolers meet 100 percent of the REA for food energy, whereas 90 percent meet the 70 percent standard of the REA. Again, because the energy REA represents the average energy needs of this age group and energy intakes and requirements are highly correlated, half the group meeting 100 percent of the REA is consistent with each member of the age group consuming a food energy amount equal to their needs. However, because we do not know the energy needs of each individual in the sample, we are not sure whether each individual preschooler consumes a sufficient amount of food energy.

Low-income, school-age children are less likely than low-income preschoolers to meet 70 percent of the RDA for most nutrients. The percentage of this group meeting 70 percent of the RDA is less than 90 percent for 5 of the 11 key nutrients: vitamin A, vitamin E, calcium, magnesium, and zinc. Calcium intake is most likely to be low among school-age children, as only 71 percent have intake exceeding 70 percent of the RDA. For vitamin A, vitamin E, magnesium, and zinc, about 80 percent of school-age children meet the RDA standard. Relatively few low-income, school-age children have low intake levels for the remaining six key nutrients. Although school-age children are less likely than preschoolers to consume adequate amounts of most nutrients, they are more likely to consume adequate amounts of vitamin E and zinc. For these nutrients, underconsumption seems to be more common among low-income preschoolers.

Just as school-age children have lower *mean* reported food energy intake than preschoolers, they also are less likely to have energy intake exceeding the REA. Only 35 percent of low-income, school-age children report energy intake at or above 100 percent of the REA for food energy, although 88 percent have reported energy intake at or above 70 percent of the REA.

Intake levels of key nutrients below 70 percent of the RDA are much more common among low-income adults. More than 90 percent of adults meet this dietary standard for only 2 of the 11 key nutrients: vitamin B_{12} and phosphorus. Low intake levels are more common for the other nine key vitamins and minerals. Underconsumption is especially common for calcium (only 54 percent of adults have intake exceeding 70 percent of the RDA), zinc (57 percent), vitamin E (58 percent), magnesium (61 percent), and vitamin A (62 percent).

Low-income adults also commonly fail to reach the REA for food energy. Only 21 percent of this group have reported energy intake at or above the REA, whereas 63 percent have intake at or above 70 percent of the REA. As noted earlier, however, the underreporting of food energy intake in dietary recall surveys suggests that the proportions of individuals failing to reach the REA shown earlier may overstate true underconsumption.

Low-income adults are also significantly less likely than high-income adults to consume adequate amounts of vitamins and minerals. For vitamin A and calcium, for example, 62 and 54 percent of low-income adults consume 70 percent of the RDA, respectively, compared with 77 and 68 percent of high-income adults. Overall, high-income adults are significantly more likely than low-income adults to reach 70 percent of the RDA for 10 of 11 key nutrients that are current or potential future public health issues. Such patterns of differences between low- and high-income individuals are not observed for preschoolers and school-age children.

2. Macronutrients and Other Dietary Components

Substantial percentages of the low-income population fall short of the recommendations in the *Dietary Guidelines* and *Diet and Health* for macronutrients and other dietary components such as fat, carbohydrates, protein, sodium, and dietary fiber. This is true of all three age groups, although there is variation in the percentages of low-income preschoolers, school-age children, and adults who meet specific guidelines, with adults generally more likely to meet the dietary guidelines.[10] Table IV.5 shows estimates of low-income individuals' intake of key macronutrients and other dietary components, as well as the percentage of individuals who meet various dietary guidelines.

One important area in which low-income individuals' diets fall short involves their consumption of saturated fat. On average, for example, low-income adults consume 33 percent of their food energy in the form of fat and 11 percent of their food energy in the form of saturated fat. These mean intake levels of fat exceed the guidelines of no more than 30 percent of food energy in the form of total fat and 10 percent in the form of saturated fat. Intake of total fat and saturated fat among preschoolers and school-age children is similar, though slightly higher than among adults. These relatively high fat intake levels translate into relatively small proportions of low-income individuals who meet the fat guidelines. In particular, 24 to 32 percent of low-income individuals meet the total fat intake guideline of no more than 30 percent of food energy. The percentage meeting the saturated fat intake guideline ranges from 14 percent for preschoolers, to 22 percent for school-age children, to 37 percent for adults.

Conversely, carbohydrate intake among low-income individuals is lower than recommended minimum levels. In particular, the mean percentage of food energy in the form of carbohydrates is 50 to 52 percent, which is somewhat less than the recommended minimum level of 55 percent. Thus, only about a third of low-income preschoolers, school-age children, and adults meet the dietary guideline for carbohydrates.

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[10]Because the dietary guidelines are intended only for individuals age two or older, the sample of preschoolers includes only two- to four-year-olds.

TABLE IV.5

INTAKE OF MACRONUTRIENTS AND OTHER DIETARY COMPONENTS

	Preschoolers		School-Age Children		Adults	
	Low-Income	High-Income[a]	Low-Income	High-Income[a]	Low-Income	High-Income[a]
Macronutrients						
Food Energy (kcal)	1,425	1,380	1,989	2,064	1,882	2,009**
Percentage of Food Energy from:						
Fat	34	31**	34	32**	33	33
Saturated fat	13	12**	12	12**	11	11
Protein	15	14**	15	14**	16	16
Carbohydrate	52	56**	52	55**	50	51
Other Dietary Components						
Dietary Fiber (g)	9	10	13	14*	14	16**
Cholesterol (mg)	213	163**	268	218**	284	262**
Sodium (mg)	2,279	2,055**	3,200	3,270	3,200	3,372*
Percentage Meeting Dietary Guidelines/ Recommendations						
No More than 30 Percent of Food Energy from Fat	24	41**	27	35**	32	33
Less than 10 Percent of Food Energy from Saturated Fat	14	28**	22	29**	37	39
More than 55 Percent of Food Energy from Carbohydrate	34	56**	36	50**	32	31
No More than Twice the RDA of Protein	20	25	55	60	87	88
More than 20 g of Dietary Fiber[b]	--	--	--	--	19	25**
No More than 300 mg of Cholesterol	79	90**	67	79**	63	69**
No More than 2,400 mg of Sodium	56	67**	29	28	36	28**
Sample Size	**571**	**1,057**	**926**	**2,198**	**2,224**	**7,161**

TABLE IV.5 *(continued)*

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: The sample of preschoolers includes only those ages two to four.

g = grams; kcal = kilocalories; mg = milligrams.

[a] Significance test refers to difference in the outcome among high-income and low-income groups. Low income is defined as household income less than 130 percent of the poverty line. High income is defined as household income higher than 130 percent of the poverty line.

[b] Diet and Health recommends that adults' usual fiber intake be between 20 and 35 grams a day. Thus, we set 20 grams as a recommendation for fiber intake for adults but did not set a recommendation for children.

-- = Not applicable.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Intake of dietary fiber among low-income individuals also tends to be below the recommended minimum level of 20 grams. For instance, adults consume an average amount of only 14 grams of fiber, and only 19 percent meet the guideline of 20 grams of fiber or more.

Low-income individuals also are unlikely to meet the dietary guideline of consuming no more than 2,400 milligrams (mg) of sodium. Low-income school-age children and adults consume an average of 3,200 mg; about one-third of the two groups meet the guideline of less than 2,400 mg. By contrast, low-income individuals' consumption of cholesterol is more likely to be in line with the dietary guideline of consuming no more than 300 mg. The mean cholesterol intake is 284 mg among low-income adults and 268 mg among low-income, school-age children; about two-thirds of these groups meet the dietary guideline for cholesterol. Intake of both sodium and cholesterol among low-income preschoolers is less than it is among older individuals.

High-income individuals are much more likely than low-income individuals to meet many of the *Dietary Guidelines*. Among preschoolers and school-age children, the percentages of high-income individuals meeting the guidelines for fat, saturated fat, carbohydrate, and cholesterol intake (and the percentage of preschoolers meeting the guideline for sodium intake) significantly exceed the percentages of low-income individuals meeting these guidelines. For example, the percentages of high-income preschoolers meeting the fat and saturated fat guidelines are 41 and 28 percent, respectively, compared with 24 and 14 percent among low-income preschoolers. Among adults, high-income individuals are more likely than low-income individuals to meet the *Dietary Guidelines* for fiber and cholesterol and are less likely to meet the guidelines for sodium.

C. SUMMARY MEASURES OF DIET QUALITY

As described in Chapter II, two measures have recently been developed that summarize the overall quality of individuals' diets: (1) the Healthy Eating Index (HEI), and (2) the Diet Quality

Index (DQI). The HEI is based on individuals' consumption of servings from the five major food groups, consumption of fat, saturated fat, sodium, and cholesterol, and the amount of variety in their diets. The DQI is based on consumption of servings of grain products and fruits or vegetables and the intake of fat, saturated fat, sodium, cholesterol, protein, and calcium. These measures, though similarly structured, are based on slightly different elements of individuals' diets and thus are scaled differently. Higher values of the HEI indicate higher-quality diets, whereas higher values of the DQI indicate lower-quality diets.[11]

Table IV.6 shows the mean values of the HEI and DQI among preschoolers, school-age children, and adults. And HEI value of 100 indicates that an individual reaches all 10 of the dietary targets being measured, whereas a value of 0 indicates that the individual is far away from each dietary target. Kennedy et al. (1999) notes that individuals having HEI values in the range of 51 to 80 are defined as having diets that "need improvement." Clearly, the diets of the average low-income individual needs improvement. In particular, the mean values in the range of 59.2 through 68.8 indicate that the quality of low-income individuals is mixed; these individuals do well in some respects but fall short in others. Mean values of high-income individuals also show mixed quality of their diets; they do well in some respects but fall short in others. However, all groups of high-income individuals have significantly higher values of the HEI than low-income individuals.[12]

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[11]Recently, Haines et al. (1999) revised the DQI. They made changes to the components upon which the DQI is based and also changed the scaling of the index, so that the range of the scale is 0 to 100 instead of 0 to 16 and so that higher values of the index indicate higher-quality diets. However, this report uses the original DQI developed by Patterson et al. (1994).

[12]The average estimates of the HEI presented here are almost identical with the estimate of the HEI among the full population (of all individuals age two or older) of 63.9 given by Kennedy et al. (1995) and based on the 1989-1990 CSFII, as well as the updated estimate of 63.6 given by Bowman et al. (1998) and based on the 1994-1996 CSFII.

TABLE IV.6

SUMMARY MEASURES OF DIET QUALITY

	Preschoolers		School-Age Children		Adults	
	Low-Income	High-Income[a]	Low-Income	High-Income[a]	Low-Income	High-Income[a]
Healthy Eating Index[b]	68.8	72.3**	62.4	65.0**	59.2	63.6**
Diet Quality Index[c]	7.7	6.5**	7.9	7.2**	7.5	6.9**
Sample Size	**571**	**1,057**	**926**	**2,198**	**2,224**	**7,161**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: Sample of preschoolers includes only those ages two to four.

[a] Significance test refers to difference in the outcome among high-income and low-income groups. Low income is defined as household income less than 130 percent of the poverty line. High income is defined as household income higher than 130 percent of the poverty line.

[b] The Healthy Eating Index (HEI) was created by Kennedy et al. (1995). Higher values of the HEI indicate healthier diets.

[c] The Diet Quality Index (DQI) was created by Patterson et al. (1994). Lower values of the DQI indicate healthier diets.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

The mean values of the DQI among low- and high-income individuals tell a similar story. For this summary measure, a "perfect" diet would lead to a DQI value of 0, whereas a diet that is poor in each dimension of the DQI would lead to a value of 16. Thus, a mean value in the range of 7.5 through 7.9 again suggests that low-income individuals are somewhere in the middle of the measured range of perfect to uniformly poor.[13] Higher-income individuals tend to have lower values of the DQI than low-income individuals, suggesting slightly better diets; however, they too are in the middle of the measured range of perfect to uniformly poor.

Overall, this analysis shows that there is clear room for improvement in the diets of low-income individuals. This suggests that there is a role for the FSP, with its benefits and nutrition education, to boost participants' dietary quality. The next chapter focuses on the relationship between FSP participation and the adequacy and quality of low-income individuals' diets.

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[13]The range of estimates of the DQI among the CSFII sample members population is less than the 8.6 estimate of the DQI among the full population of all adults given by Patterson et al. (1994) (suggesting higher-quality diets among our study sample members), based on the 1987-1988 Nationwide Food Consumption Survey (NFCS). Haines et al. (1994) analyzed a sample of adults from the 1994 CSFII and found that the mean value of the revised DQI was 63.4.

V. ESTIMATING THE RELATIONSHIP BETWEEN FSP PARTICIPATION AND DIETARY INTAKE

This chapter presents estimates of the effects of Food Stamp Program (FSP) participation on a variety of measures of dietary intake and diet quality. These measures include *dietary habits*, *consumption of servings of food* from the major food groups, *intake of a variety of nutrients* and other dietary components, and the quality of people's overall diets as measured by *diet quality composite measures*. The chapter then presents the results of additional analysis intended to help in the interpretation of the basic results. The additional analysis includes estimates of whether food stamp participation influences the sources from which individuals obtain their food, whether the effects of FSP participation on key outcomes differ for subgroups of the low-income population, and whether the basic results are sensitive to alternative model specifications.

The results of the analysis are presented in this chapter as regression-adjusted estimates of the means of the dietary outcomes among FSP participants and nonparticipants. The difference between the regression-adjusted mean outcome among participants and the regression-adjusted mean outcome among nonparticipants is an estimate of the *effect of participation on the outcome for the average FSP participant*. The regression adjustment in effect controls for observable differences between participants and nonparticipants in generating this estimate of the effect of food stamps.

The model used to estimate the effects of food stamp benefits on nutrient intake, as described in Chapter II, measures food stamp benefits as a single continuous variable (representing the monthly per-capita food stamp benefit amount received by the household). To measure the regression-adjusted value of an outcome variable, it was assumed that participants received the mean per-capita benefit amount for the relevant age group (preschoolers, school-age children, or adults), and nonparticipants received 0 benefits. The remaining variables in the model (other than the benefits variable) were set to their actual values for all individuals, and these values, along with our coefficient estimates, were used to calculate a regression-adjusted nutrient intake value.

The regression model includes as control variables a variety of factors that reflect the economic and demographic condition of individual households. These variables include age, gender, race, household structure, educational attainment, a variety of measures of individuals' income and assets, benefit receipt from other public assistance programs, region and urbanicity of residence, indicators of health status, dietary knowledge and attitude measures, and several other miscellaneous measures.[1]

One important analytic issue concerns selection bias. The analysis uses a nonexperimental design, whereby the dietary intake of participants is compared with the dietary intake of nonparticipants after controlling for a variety of observed characteristics. However, if the unobserved characteristics of the two groups differ, then these unobserved differences, rather than FSP participation, may be what leads to differences in the two groups' dietary intakes. One type of unobserved difference often cited in past literature involves the groups' dietary knowledge and attitudes. A key aspect of this study is that the models measuring the relationship between FSP participation and dietary intake control for the dietary knowledge and attitudes of adults.[2] Since the model directly controls for these characteristics, then this factor is no longer a possible source of

[1]The full set of independent variables used in the regression models is shown in Chapter II, Table II.5. Although a discussion of the relationships between each of these control variables and dietary intake is beyond the scope of this report, the full regression results for selected dietary outcomes are presented in Appendix D.

[2]The inclusion of dietary knowledge and attitude measures in the models of the relationship between FSP participation and dietary intake are complicated by the fact that these measures are available only for the DHKS sample, which is a subsample of adults in the CSFII sample. Thus, the dietary knowledge and attitude variables are included only in the models for adults. Furthermore, the values are imputed for individuals not in the DHKS sample, and a dummy variable representing inclusion in the DHKS sample is included in the model.

unobserved differences between participants and nonparticipants and the resulting selection bias. An important finding of this study is that the inclusion of dietary knowledge and attitude measures did not greatly influence the model's estimation of the participation-dietary intake relationship.

A second important analytic issue concerns the power of the analysis to detect potentially small effects of FSP participation on dietary intake. If the true effect of participation on dietary intake is positive but relatively small, the analysis may not be able to generate an estimate of this effect with sufficient precision to be statistically significant. Two factors limit the precision of the regression model's estimates. First, since the estimates are based on a sample of the low-income population rather than the entire population, the estimates are subject to sampling error. Second, because the dependent variables in the analysis attempt to measure individuals' usual dietary intake but are based on just two days of dietary intake data, these outcome variables are subject to a certain amount of measurement error. The limited power of the analysis implies that if estimates of the effect of participation turn out to be statistically insignificant, this would only rule out the possibility that the effects are large. One could not use statistically insignificant estimates to distinguish between the possibility that participation has no effect on dietary intake and the possibility that the effects are small (and either positive or negative).

A. EFFECTS ON DIETARY HABITS AND FOOD GROUP CONSUMPTION

This section explores the effects of FSP participation on the types and amounts of foods that participants eat and the ways in which these foods are prepared and served. These outcomes were measured using two types of variables. The dietary behavior factor measures low-income adults' usual dietary practices, including the types of foods these people usually do or do not eat, how certain types of foods are prepared, and how certain types of foods are served. The second set of variables measures their consumption of servings from the five basic food groups, as measured on the two days for which the Continuing Survey of Food Intakes by Individuals (CSFII) collected intake data.

Once low-income adults' age/gender, dietary knowledge and attitudes, and various other factors are controlled for, FSP participation has little effect on dietary behavior. The dietary behavior index, which measures individuals' usual dietary patterns with respect to fat and cholesterol, is essentially the same for participants and nonparticipants after accounting for these other factors. This suggests that, all else being equal, participants and nonparticipants are equally likely (or unlikely) to engage in behaviors that might limit their fat and cholesterol intake, such as eating fish and poultry instead of red meat, refraining from putting butter or margarine on cooked vegetables, and eating chips less than once a week.

One might expect FSP participation to influence individuals' consumption of specific types of foods. The extra resources provided by food stamps may allow participants to purchase more food or different types of food (if desirable or more convenient). If these influences are important, they may affect the number of servings of the major food groups consumed by participants and nonparticipants. Table V.1 shows estimates of the regression-adjusted mean number of servings consumed by the two groups.

The analysis reveals few differences between the food group choices of FSP participants and low-income nonparticipants. Among preschoolers, all else being equal, participants consume significantly fewer grain products than nonparticipants. Among low-income adults, participants consume significantly fewer servings of vegetables than nonparticipants. However, other than these two differences, the intake among preschoolers, school-age children, and adults of fruit, vegetables, grain products, dairy products, and meat and meat substitutes, as well as discretionary fat and/or

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TABLE V.1

EFFECT OF FOOD STAMP PARTICIPATION ON INTAKE OF FOOD GROUP SERVINGS AND OTHER DIETARY COMPONENTS
(Low-Income Individuals)

Food Group Servings	Regression-Adjusted Mean: FSP Participants	Regression-Adjusted Mean: Nonparticipants	Difference
Preschoolers (Ages 2 to 4)			
Grain Products	5.7	6.2	-0.5*
Vegetables	2.4	2.2	0.2
Fruit	1.9	1.9	-0.0
Dairy Products	1.7	1.9	-0.2
Meat and Meat Substitutes			
Red meat	0.6	0.7	-0.1
Poultry	0.3	0.3	0.0
Fish	<0.1	0.1	-0.0
Eggs	0.1	0.2	-0.1
Nuts and seeds	0.1	0.1	0.0
Total	1.2	1.3	-0.1
Grams of Discretionary Fat	42.5	43.6	-1.1
Teaspoons of Added Sugar	13.0	12.5	0.5
School-Age Children			
Grain Products	6.6	6.9	-0.3
Vegetables	2.7	2.8	-0.1
Fruit	1.4	1.3	0.1
Dairy Products	1.9	1.8	0.1
Meat and Meat Substitutes			
Red meat	1.0	1.1	-0.1
Poultry	0.4	0.4	-0.0
Fish	0.1	0.1	-0.0
Eggs	0.2	0.2	0.0
Nuts and seeds	<0.1	<0.1	0.0
Total	1.7	1.8	-0.1
Grams of Discretionary Fat	57.7	57.8	-0.1
Teaspoons of Added Sugar	22.3	22.6	-0.3
Number of Alcoholic Drinks	<0.1	0.1	-0.0

TABLE V.1 *(continued)*

	Regression-Adjusted Mean		
Food Group Servings	FSP Participants	Nonparticipants	Difference
Adults			
Grain Products	6.2	6.3	-0.1
Vegetables	3.0	3.2	-0.2*
Fruit	1.2	1.2	-0.0
Dairy Products	1.2	1.2	0.0
Meat Group			
Red meat	1.2	1.1	0.0
Poultry	0.5	0.5	0.0
Fish	0.1	0.2	-0.1*
Eggs	0.2	0.2	0.0
Nuts and seeds	<0.1	<0.1	0.1
Total	2.0	2.0	0.0
Grams of Discretionary Fat	53.0	53.1	-0.1
Teaspoons of Added Sugar	18.9	18.1	0.8
Number of Alcoholic Drinks	0.3	0.4	-0.1
Sample Size			
Preschoolers	**419**	**366**	**785**
School-Age Children	**442**	**484**	**926**
Adults	**602**	**1,622**	**2,224**

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals and Diet and Health Knowledge Survey (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions of dietary intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean serving levels are based on these regression results, along with the assumption that participants receive the mean level of FSP benefits for their group ($65.01 for preschoolers, $60.88 for school-age children, and $57.86 for adults). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The levels of statistical significance reported in the difference column are based on the significance level of the coefficient on the food stamp benefit variable, and standard errors for these estimates are shown in Appendix E. The full set of regression results for selected nutrients is shown in Appendix D.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

added sugar are no different for participants than for nonparticipants.[3] Thus, despite the fact that food stamps are required to be used in food stores and bring added resources for purchasing food into low-income households, there is little evidence that this leads to greater (or lesser) consumption of specific types of foods.

The food groups shown in Table V.1, however, comprise fairly broad collections of foods. It is possible that food stamp benefits may influence the food choices of low-income individuals in more refined ways than could be captured with the food group variables. For example, participants may have consumed different types of vegetables or different cuts of red meat. Alternatively, error in the measurement of the number of servings from the food groups may have obscured the true effects of the FSP. The next section looks for program effects on a different set of measures of dietary intake: the intake of specific nutrients and other dietary components.

B. EFFECTS ON NUTRIENT INTAKE

This section presents estimates of the effects of FSP participation on both the intake of food energy and key vitamins and minerals and the intake of macronutrients and other dietary components. The focus is primarily on the estimates of the effect of participation on *mean* intake levels (either in absolute terms or relative to the RDA). Also presented is the estimated effect of participation on whether individuals meet specific dietary standards, such as exceeding 70 percent of the RDA for vitamins and minerals or meeting the *Dietary Guidelines*. However, these outcomes

[3]T-tests were conducted to determine whether the estimated effects are statistically significant using 1 and 5 percent confidence levels. (The null hypothesis for these tests was that there is no difference between the regression-adjusted means for the participant and nonparticipant groups.) At these confidence levels, however, approximately 1 or 5 percent of independent tests will yield a statistically significant effect when there is no true program effect (known as Type 1 error).

are based on individuals' two-day average intakes rather than on their usual intakes.[4] Thus, estimates of the effect of FSP participation on whether individuals meet specific dietary standards should be viewed only as suggestive of the effect of participation on the percentage of individuals whose *usual* intake meets these guidelines.

1. Food Energy and Key Micronutrients

Among low-income individuals, FSP participation does not appear to lead to significantly higher food energy or vitamin and mineral intake levels for preschoolers, school-age children, or adults. After adjustment for individual characteristics and other factors that influence nutrient intake, participants' intake of food energy and key vitamins and minerals is about the same as nonparticipants' intake of these nutrients.

Among low-income preschoolers, for example, both FSP participants and nonparticipants have mean food energy intake that is 101 percent of the Recommended Energy Allowance (REA) for food energy, holding other factors constant (Table V.2). Among the 14 vitamins and minerals examined, the estimated effect of FSP participation on intake was found to be statistically significant only for iron, and this effect is negative, with participants estimated to consume less than nonparticipants on average, holding other factors constant. The estimated effects of FSP participation on low-income preschoolers' likelihood of exceeding 70 percent of the RDA for these micronutrients are similar. None of these effects is statistically significant, and most are close to zero.

FSP participation also appears to have little effect on micronutrient intake among low-income, school-age children. For this group, the regression-adjusted mean food energy intake is 89 percent of the REA among participants and 90 percent of the REA among nonparticipants (Table V.3).

[4]While it is possible to adjust the distribution of two-day average intakes to estimate the distribution of usual intakes for a population group, it is not possible to adjust the two-day average intake *of an individual* to estimate his or her usual intake for use in estimation of a regression model.

TABLE V.2

EFFECT OF FOOD STAMP PARTICIPATION ON NUTRIENT INTAKE:
LOW-INCOME PRESCHOOLERS

	Nutrient Intake Relative to the RDA			Percentage Meeting RDA Standard[a]		
	Regression-Adjusted Mean			Regression-Adjusted Percentage		
	FSP Participants	Nonparticipants	Difference	FSP Participants	Nonparticipants	Difference
Macronutrients						
Food energy	101	101	0	47	43	4
Protein	298	308	-10	100	100	0
Vitamins						
Vitamin A	160	180	-20	85	90	-5
Vitamin C	230	225	5	87	90	-3
Vitamin E	77	80	-3	51	50	1
Vitamin B_6	127	136	-9	86	89	-3
Vitamin B_{12}	461	508	-47	100	100	0
Niacin	146	152	-6	91	90	1
Thiamin	158	166	-8	95	97	-2
Riboflavin	195	202	-7	99	99	0
Folate	348	373	-25	100	100	0
Minerals						
Calcium	97	101	-4	70	68	2
Iron	111	121	-10*	79	81	-2
Magnesium	208	214	-7	98	100	-2
Phosphorus	205	209	-3	90	92	-2
Zinc	80	83	-3	51	58	-7
Sample Size	**419**	**366**	**785**	**419**	**366**	**785**

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions of nutrient intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean intake levels and mean percentages meeting 70 percent (100 percent) of the RDA among participants are based on these regression results, along with the assumption that participants receive the mean level of FSP benefits among preschoolers ($65.01). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The levels of statistical significance reported in the difference column are based on the significance level of the coefficient on the food stamp benefit variable, and standard errors for these estimates are shown in Appendix E. The full set of regression results for selected nutrients is shown in Appendix D.

[a] The standard used for food energy was 100 percent of the REA; for the remaining nutrients, 70 percent of the RDA was used.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

TABLE V.3

EFFECT OF FOOD STAMP PARTICIPATION ON NUTRIENT INTAKE:
LOW-INCOME, SCHOOL-AGE CHILDREN

	Nutrient Intake Relative to the RDA			Percentage Meeting RDA Standard[a]		
	Regression-Adjusted Mean			Regression-Adjusted Percentage		
	FSP Participants	Nonparticipants	Difference	FSP Participants	Nonparticipants	Difference
Macronutrients						
Food energy	89	90	-1	35	32	3
Protein	200	207	-7	98	98	0
Vitamins						
Vitamin A	112	116	-4	60	61	-1
Vitamin C	200	191	9	81	80	1
Vitamin E	83	83	0	58	56	2
Vitamin B_6	114	112	2	79	79	0
Vitamin B_{12}	298	342	-44	94	97	-3
Niacin	134	136	-2	89	91	-2
Thiamin	145	141	4	91	94	-3
Riboflavin	154	149	5	92	93	-1
Folate	210	192	18*	88	91	-3
Minerals						
Calcium	89	87	2	61	61	0
Iron	125	126	-1	85	83	2
Magnesium	110	110	0	74	73	1
Phosphorus	140	140	0	88	87	1
Zinc	90	93	-3	65	68	-3
Sample Size	**442**	**484**	**926**	**442**	**484**	**926**

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions of nutrient intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean intake levels and mean percentages meeting 70 percent (100 percent) of the RDA among participants are based on these regression results, along with the assumption that participants receive the mean level of FSP benefits among school-age children ($60.88). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The levels of statistical significance reported in the difference column are based on the significance level of the coefficient on the food stamp benefit variable, and standard errors for these estimates are shown in Appendix E. The full set of regression results for selected nutrients is shown in Appendix D.

[a] The standard used for food energy was 100 percent of the REA; for the remaining nutrients, 70 percent of the RDA was used.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Furthermore, participation significantly affects the intake of only one of the micronutrients examined: participants are estimated to have higher folate intake, all else being equal. However, the mean intake of folate among both participants and nonparticipants is well above the RDA value. Not surprisingly, therefore, the positive effect of FSP participation on mean folate intake does not translate into a significantly larger percentage of school-age children exceeding 70 percent of the RDA for folate. In fact, FSP participation does not have a significant positive effect on the likelihood of school-age children meeting 70 percent of the RDA for any of the micronutrients examined.

Among low-income adults, mean food energy intake among both participants and nonparticipants is estimated to be 79 percent of the REA, after controlling for other factors (Table V.4). Furthermore, FSP participation does not have a significant positive effect on either the mean intake level or the percentage meeting 70 percent of the RDA for any of the nutrients examined, and the estimated effects are nearly all close to zero.

Thus, the basic model suggests that the added resources food stamps bring into low-income households do not lead to greater intake of food energy or vitamins and minerals overall. The study found that, after controlling for a large set of relevant characteristics, the intake levels of FSP participants and nonparticipants appear to be about the same. This does not necessarily mean that food stamps have no effect on eating patterns, as the extent to which participants and nonparticipants eat at home with foods purchased from stores versus eating at restaurants may differ. Alternatively, FSP benefits may lead to increased intake levels for specific subgroups of the low-income population, such as those with the very lowest income levels. In addition, it is possible that unobservable

TABLE V.4

EFFECT OF FOOD STAMP PARTICIPATION ON NUTRIENT INTAKE:
LOW-INCOME ADULTS

	Nutrient Intake Relative to the RDA			Percentage Meeting RDA Standard[a]		
	Regression-Adjusted Mean			Regression-Adjusted Percentage		
	FSP Participants	Nonparticipants	Difference	FSP Participants	Nonparticipants	Difference
Macronutrients						
Food energy	79	79	0	23	21	2
Protein	134	134	0	89	88	1
Vitamins						
Vitamin A	98	101	-4	47	49	-2
Vitamin C	149	146	3	67	67	0
Vitamin E	78	82	-4	47	51	-4
Vitamin B_6	90	91	-1	63	62	1
Vitamin B_{12}	242	261	-19	87	86	1
Niacin	129	130	-1	87	87	0
Thiamin	121	119	2	84	83	1
Riboflavin	120	119	1	81	82	-1
Folate	118	121	-3	73	72	1
Minerals						
Calcium	79	79	0	48	47	1
Iron	120	123	-3	73	73	0
Magnesium	77	80	-3	53	55	-2
Phosphorus	162	163	-1	85	85	0
Zinc	80	79	1	50	51	-1
Sample Size	**602**	**1,622**	**2,224**	**602**	**1,622**	**2,224**

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals and Diet and Health Knowledge Survey (the regression-adjusted mean values were calculated using sample weights although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions of nutrient intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean intake levels and mean percentages meeting 70 percent (100 percent) of the RDA among participants are based on these regression results, along with the assumption that participants receive the mean level of FSP benefits among adults ($57.86). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The levels of statistical significance reported in the difference column are based on the significance level of the coefficient on the food stamp benefit variable, and standard errors for these estimates are shown in Appendix E. The full set of regression results for selected nutrients is shown in Appendix D.

[a] The standard used for food energy was 100 percent of the REA; for the remaining nutrients, 70 percent of the RDA was used.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

differences between FSP participants and nonparticipants may be influencing the estimated effects. These issues are examined later in this chapter.[5]

2. Macronutrients and Other Dietary Components

Just as food stamp benefits appear not to have influenced food energy or micronutrient intake, the results show little evidence of effects on the intake of key macronutrients and other dietary components. All else being equal, with a few exceptions, FSP participants and nonparticipants have largely similar intake levels of fat, protein, carbohydrate, fiber, cholesterol, and sodium. Participants and nonparticipants also appear to be equally likely to meet the *Dietary Guidelines*.

Among low-income preschoolers, FSP participants and nonparticipants have similar regression-adjusted mean intake levels of fat and saturated fat as a percentage of food energy (Table V.5). Participation has a significant negative effect on intake of protein as a percentage of food energy. The only guideline significantly affected by FSP participation is consuming less than 10 percent of food energy from saturated fat. Although both participants and nonparticipants are unlikely to meet this guideline, the regression-adjusted percentage of participants meeting this guideline is seven percentage points less than the percentage of nonparticipants meeting the guideline.

Among low-income school-age children, FSP participation does not significantly affect mean intake of any of the macronutrients and other dietary components examined (Table V.6). FSP participants and nonparticipants within this age group are also equally likely to meet the *Dietary Guidelines*.

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[5]Another possibility is that the nutrient intake model has been misspecified, resulting in biased estimates of the effect of FSP participation on intake. Section D of this chapter examines whether some type of misspecification may be driving the results.

TABLE V.5

EFFECT OF FOOD STAMP PARTICIPATION ON INTAKE OF MACRONUTRIENTS AND OTHER DIETARY COMPONENTS: LOW-INCOME PRESCHOOLERS

	Regression-Adjusted Mean/ Percentage Meeting Dietary Guideline		
	FSP Participants	Nonparticipants	Difference
Percentage of Food Energy from:			
Fat	34.1	34.2	0.1
Saturated fat	13.4	13.5	0.1
Protein	14.9	15.5	-0.6*
Carbohydrate	52.2	51.5	0.7
Intake of:			
Dietary fiber (g)	9.1	9.4	0.3
Cholesterol (mg)	208.3	219.5	-11.2
Sodium (mg)	2,248.8	2,317.0	-68.2
Percentage Meeting Dietary Guidelines:			
No more than 30 percent of food energy from fat	22	27	-5
Less than 10 percent of food energy from saturated fat	11	18	-7*
More than 55 percent of food energy from carbohydrate	34	31	3
No more than two times the RDA of protein	21	16	5
No more than 300 mg of cholesterol	81	77	4
No more than 2,400 mg of sodium	58	60	-2
Sample Size	**419**	**366**	**785**

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions of dietary intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean intake levels and mean percentages meeting dietary guidelines among participants are based on these regression results, along with the assumption that participants receive the mean level of FSP benefits among preschoolers ($65.01). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The levels of statistical significance reported in the difference column are based on the significance level of the coefficient on the food stamp benefit variable, and standard errors for these estimates are shown in Appendix E. The full set of regression results for selected nutrients is shown in Appendix D.

g = grams; mg = milligrams.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

TABLE V.6

EFFECT OF FOOD STAMP PARTICIPATION ON INTAKE OF MACRONUTRIENTS AND OTHER DIETARY COMPONENTS: LOW-INCOME, SCHOOL-AGE CHILDREN

	Regression-Adjusted Mean/ Percentage Meeting Dietary Guideline		
	FSP Participants	Nonparticipants	Difference
Percentage of Food Energy from:			
Fat	33.7	33.6	.1
Saturated fat	12.1	12.1	0.0
Protein	14.7	15.0	-0.3
Carbohydrate	52.5	52.3	0.2
Intake of:			
Dietary fiber (g)	12.7	13.1	-0.4
Cholesterol (mg)	267.0	268.1	-1.1
Sodium (mg)	3,172.7	3,225.7	-53.0
Percentage Meeting Dietary Guidelines:			
No more than 30 percent of food energy from fat	28	24	4
Less than 10 percent of food energy from saturated fat	23	20	3
More than 55 percent of food energy from carbohydrate	38	37	1
No more than two times the RDA of protein	57	54	3
No more than 300 mg of cholesterol	70	66	4
No more than 2,400 mg of sodium	29	32	-3
Sample Size	**422**	**484**	**926**

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions of dietary intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean intake levels and mean percentages meeting dietary guidelines among participants are based on these regression results, along with the assumption that participants receive the mean level of FSP benefits among school-age children ($60.88). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The levels of statistical significance reported in the difference column are based on the significance level of the coefficient on the food stamp benefit variable, and standard errors for these estimates are shown in Appendix E. The full set of regression results for selected nutrients is shown in Appendix D.

g = grams; mg = milligrams.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Among adults, although FSP participation is not significantly related to fat, protein, or carbohydrate intake as a percentage of food energy, participation does have a significant negative effect on dietary fiber intake, with participants consuming an average of 13.5 grams and nonparticipants consuming an average of 14.4 grams of dietary fiber per day (Table V.7). Although neither group has a large percentage of individuals meeting the goal of consuming 20 grams of fiber per day, nonparticipants are significantly more likely than participants to meet the guideline for fiber intake.

Overall, there is little evidence that participation systematically affects intake of macronutrients and other dietary components among low-income preschoolers and school-age children. Among adults, there is some evidence that FSP benefits influence participants' diets in such a way as to lower their fiber intake, which is consistent with the estimate of a negative effect of participation on consumption of servings of vegetables. However, participation does not significantly affect the intake of macronutrients and other dietary components (except for fiber) among adults.

C. EFFECTS ON OVERALL DIET QUALITY

The first two sections of this chapter have examined the effects of FSP participation on food group consumption (as well as dietary behavior) and nutrient intake. The overall quality or adequacy of a person's diet depends on a number of factors represented by both food consumption and nutrient intake. For example, as described in Chapter II, both the Healthy Eating Index (HEI) and the Diet Quality Index (DQI) include components that measure the number of servings individuals consume of different food groups and their intake of dietary components such as fat and cholesterol. Thus, to summarize the effects of FSP participation on dietary adequacy, the effects of participation on these composite measures of diet quality (the HEI and DQI) are measured.

TABLE V.7

EFFECT OF FOOD STAMP PARTICIPATION ON INTAKE OF MACRONUTRIENTS AND OTHER DIETARY COMPONENTS: LOW-INCOME ADULTS

	Regression-Adjusted Mean/ Percentage Meeting Dietary Guideline		
	FSP Participants	Nonparticipants	Difference
Percentage of Food Energy from:			
Fat	33.5	33.3	0.2
Saturated fat	11.3	11.1	0.2
Protein	16.2	16.2	0.0
Carbohydrate	50.4	50.4	0.0
Intake of:			
Dietary fiber (g)	13.5	14.4	-0.9*
Cholesterol (mg)	289.0	282.7	7.3
Sodium (mg)	3,289.0	3,160.2	128.8
Percentage Meeting Dietary Guidelines:			
No more than 30 percent of food energy from fat	32	32	0
Less than 10 percent of food energy from saturated fat	36	38	-2
More than 55 percent of food energy from carbohydrate	31	32	-1
No more than two times the RDA of protein	86	89	-3
More than 20 g of fiber	14	21	-7**
No more than 300 mg of cholesterol	62	63	-1
No more than 2,400 mg of sodium	36	36	0
Sample Size	**602**	**1,622**	**2,224**

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals and Diet and Health Knowledge Survey (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions of dietary intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean intake levels and mean percentages meeting dietary guidelines among participants are based on these regression results, along with the assumption that participants receive the mean level of FSP benefits among adults ($57.86). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The levels of statistical significance reported in the difference column are based on the significance level of the coefficient on the food stamp benefit variable, and standard errors for these estimates are shown in Appendix E. The full set of regression results for selected nutrients is shown in Appendix D.

g = grams; mg = milligrams.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

Because FSP participation has few significant effects on the components that make up these diet quality variables, it is unlikely that participation will significantly influence either the HEI or the DQI. It is possible, however, that a set of statistically insignificant effects--if they are all in a consistent direction--could lead to a statistically significant effect of participation on the composite measure of diet quality. Alternatively, the few cases where FSP participation significantly affects food or nutrient intake (for example, the significant effect on mean sodium intake among low-income adults) could drive an overall effect on diet quality.

However, the regression analysis of diet quality indicates that FSP participation is not significantly associated with the mean diet quality of participants as it is measured by the HEI or DQI. Thus, these diet quality results are consistent with the food and nutrient intake results. For all three age groups, the regression-adjusted mean value of the HEI is not significantly different for participants and nonparticipants, although it is slightly lower for participants (Table V.8). Similarly, the effect of participation on the mean value of the DQI also is statistically insignificant for all three age groups.

D. SUPPLEMENTAL ANALYSIS

Estimation of the basic model suggests that FSP participation has little overall effect on dietary outcomes. Before concluding that food stamps do not affect participants' diets, however, we need to test alternative models of the effects of participation. Designed to help interpret the results, these alternative models fall into one of two categories. The first set of models examines whether participation may influence dietary intake in specific ways even if it does not influence overall dietary intake among the full low-income population. For example, perhaps the program affects where participants get their food. Even if the overall effect on food intake is close to zero, participation may lead to shifts in the sources of food, as individuals substitute store-bought foods

TABLE V.8

EFFECTS OF FOOD STAMP PROGRAM PARTICIPATION ON OVERALL DIET QUALITY
(Low-Income Individuals)

	Regression-Adjusted Mean/ Percentage Meeting Dietary Guideline		
	FSP Participants	Nonparticipants	Difference
Preschoolers (Ages 2 to 4)			
Healthy Eating Index	68.3	69.4	-1.1
Diet Quality Index	7.7	7.6	0.1
School-Age Children			
Healthy Eating Index	62.3	62.6	-0.3
Diet Quality Index	7.8	8.0	-0.2
Adults			
Healthy Eating Index	58.8	59.4	-0.6
Diet Quality Index	7.6	7.5	0.1
Sample Size	**602**	**1,622**	**2,224**

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals and Diet and Health Knowledge Survey (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The Healthy Eating Index (HEI) was originally created by Kennedy et al. (1995). Higher values of the HEI represent healthier diets. See Bowman et al. (1998) for more recent analysis of the HEI. The Diet Quality Index (DQI) was originally created by Patterson et al. (1994). Lower values of the original DQI represent higher quality diets. Haines et al. (1999) revised this index and analyzed it with more recent data. This table uses the original DQI, however.

The estimates contained in this table are based on a set of regressions of dietary intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean serving levels are based on these regression results, along with the assumption that participants receive the mean level of FSP benefits for their group ($65.01 for preschoolers, $60.88 for school-age children, and $57.86 for adults). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The levels of statistical significance reported in the difference column are based on the significance level of the coefficient on the food stamp benefit variable, and standard errors for these estimates are shown in Appendix E. The full set of regression results for selected nutrients is shown in Appendix D.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

for foods obtained from eating out at restaurants or from other sources (such as school meals, other people, or soup kitchens). Alternatively, even with no significant overall effect on dietary intake, FSP participation may influence intake among specific subgroups of the low-income population, such as the poorest members of this group or those individuals with specific dietary attitudes.

The second set of alternative models is designed to help determine whether the results of the basic model may have been biased due to some sort of misspecification. These models allow for different types of relationships between the independent and dependent variables. For example, one model allows FSP benefits to have a nonlinear effect on dietary intake. Should one of these alternative models lead to qualitatively different conclusions about the effect of participation on intake, the conclusion would be that the results are not robust, and further analysis would be needed to determine whether the basic model's estimates were biased.

1. Effects on Where Foods Are Obtained

Food stamps increase the resources available to households for the purchase of food but can only be used in authorized food stores. Thus, FSP participation may affect the source from which individuals obtain their food--stores, restaurants, or other sources. For instance, the increased food resources provided by the FSP program along with the fact that food stamps can only be used in authorized food stores may lead participating households to obtain more of their food from stores than they would have if they had not received food stamps. Alternatively, nonparticipating low-income households may have a preference for eating out, but their lack of resources may prevent them from spending the extra money it takes to do so. Low-income households that receive food stamps will have greater resources for spending on food and may substitute restaurant food for store-bought food. In this scenario, FSP participation will lead to a decrease in the proportion of low-income individuals' diets consisting of store-bought foods and a corresponding increase in the proportion made up of restaurant-bought foods. The CSFII contains information on where each food item the sample member consumed was obtained. Based on this information, foods were classified into three groups: (1) foods purchased from food stores; (2) foods purchased from restaurants, bars, cafeterias, and vending machines; and (3) foods obtained free from other sources (such as free or reduced-price school meals, soup kitchens, or other people).[6]

Low-income adults and children, on average, obtain nearly three-quarters of their calories from store-bought foods (Table V.9). Eating store-bought foods is most common among preschoolers--only 11 and 7 percent of their food energy, respectively, comes from foods obtained from restaurants and other sources. Among school-age children, about two-thirds of their food energy comes from store-bought foods and 20 percent comes from "other" foods, largely reflecting school breakfasts and lunches.[7] Finally, low-income adults obtain three-fourths of their food energy from store-bought foods, with most of the rest (18 percent) coming from restaurant-bought foods. "Other" foods make up eight percent of low-income adults' food energy. The percentage of individual nutrients that low-income people get from various sources follows the same pattern of intake across the three categories of food sources as the pattern for food energy (Appendix Tables C.8 to C.10).

Before controlling for other factors among adults, participants consume significantly more food energy from store-bought foods and less from restaurant-bought foods (Table V.9). Among school-

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[6]This category of foods includes any foods obtained from school cafeterias, even by students who were not reported as being certified for free or reduced-price meals. This was done in order to keep food obtained from the same source (the school cafeteria) in the same category for all individuals.

[7]Although Burghardt et al. (1993) found that 38 percent of children's food energy came from school meals, this percentage was measured only on school days among school meal participants. Gleason and Suitor (1999) found that 19 percent of food energy came from foods obtained in the school cafeteria on school days among a sample of participants and nonparticipants. This percentage does not include "other" foods that were not from the school cafeteria. However, it is based on only school days. The CSFII dietary intake data include weekends, vacation days, and summer days when most children are not in school.

TABLE V.9

DISTRIBUTION OF NUTRIENT INTAKE, BY WHERE FOODS WERE OBTAINED
(Low-Income Individuals)

	Preschoolers			School-Age Children			Adults		
	All	FSP Participants	Non-participants	All	FSP Participants	Non-participants	All	FSP Participants	Non-participants
Percentage of Food Energy from Food Source									
Store-bought foods	82	81	84	68	69	66	75	79	73**
Restaurant-bought foods	11	11	10	13	10	15**	18	14	19**
Other foods	7	8	6*	20	22	19	8	7	8
Sample Size	**785**	**419**	**366**	**926**	**442**	**484**	**2,224**	**602**	**1,622**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: Tests of statistical significance were conducted after taking into account design effects due to complex sampling and sample weights.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

age children, participants consume significantly less from restaurant-bought foods, while participants who are preschoolers consume significantly more from "other" sources.

After controlling for relevant factors, FSP participation does not significantly affect where low-income preschoolers obtain their foods. The percentage of food energy from the three food sources is about the same for participants and nonparticipants, all else equal (Table V.10). The effect of participation on vitamin and mineral intake from each source tends to be negative but statistically insignificant, especially for store-bought and restaurant-bought foods. The effect of participation on intake from "other" foods also is negative but is more likely to be statistically significant.[8]

On the other hand, the effects of FSP participation on intake from store-bought, restaurant-bought, and other foods among low-income, school-age children and adults show clear patterns. Among school-age children, food stamps lead to a significant increase (of five percentage points) in the percentage of individuals' food energy that comes from store-bought foods and a decrease in the percentage that comes from restaurant-bought foods (a statistically significant three percentage point effect) and other foods (a statistically insignificant two percentage point effect) (Table V.11). This effect on the distribution of food energy across the three food sources extends to most of the dietary components examined. Because the overall effect of participation on nutrient intake (from all sources) among school-age children is close to zero for most nutrients, the effect on vitamin and mineral intake from store-bought foods tends to be positive (and often statistically significant),

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[8]In general, the sum of the three effects will not sum exactly to the overall effect because different estimation methods were used in the model of intake from store-bought foods versus the models of intake from restaurant-bought and other foods (the models for store-bought foods are linear models, whereas the other two models are nonlinear). In particular, because there was a large number of sample members whose intake of a particular nutrient from restaurant-bought or other foods on the two intake days was zero, tobit models (rather than ordinary least squares [OLS] models) were estimated, which could accommodate censoring at zero for these outcomes.

TABLE V.10

EFFECT OF FOOD STAMP PARTICIPATION ON NUTRIENT INTAKE,
BY WHERE FOODS WERE OBTAINED:
LOW-INCOME PRESCHOOLERS

	Effect of FSP Participation on Intake from:		
Outcome	Store-Bought Foods	Restaurant-Bought Foods	Foods Obtained from Other Sources
Percentage of Food Energy from Food Source	-0.3	0.4	-1.6
Intake as a Percentage of the RDA			
Food energy	0.3	0.3	-2.0
Protein	-7.2	-0.9	-6.5
Vitamin A	-16.4	-3.0	-2.2
Vitamin C	8.0	-2.3	-3.5
Vitamin E	-2.2	0.0	-3.8*
Vitamin B_6	-8.0	-0.5	-3.0
Vitamin B_{12}	-28.7	-10.6	-12.1
Niacin	-6.1	1.8	-3.7
Thiamin	-6.3	-1.1	-3.3
Riboflavin	-5.1	-1.4	-3.7
Folate	-22.9	-1.8	-7.9
Calcium	-3.3	-0.6	-1.5
Iron	-10.7*	-0.1	-2.1
Magnesium	-5.7	-0.7	-3.3
Phosphorus	-2.3	-0.4	-2.2
Zinc	-1.7	-0.4	-1.9
Percentage of Food Energy from:			
Fat	0.2	-1.0	-5.8*
Saturated fat	0.1	-1.1	-2.6
Protein	-0.7*	-1.2	1.0
Carbohydrate	0.5	2.0	4.1
Intake of:			
Fiber (g)	-0.3	0.0	-0.2
Cholesterol (mg)	-7.7	-0.9	-5.3
Sodium (mg)	-50.4	-8.9	-40.8

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions from the three sources of nutrient intake on a series of independent variables, including food stamp benefits. Mean values of the outcomes from the three sources for all low-income individuals are shown in Appendix C. The levels of statistical significance are based on the significance level of the coefficient on the food stamp benefit variable. The full set of regression results for selected nutrients is shown in Appendix D. Standard errors for the impact estimates are shown in Appendix E.

g = grams; mg = milligrams.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

TABLE V.11

EFFECT OF FOOD STAMP PARTICIPATION ON NUTRIENT INTAKE, BY WHERE FOODS WERE OBTAINED: LOW-INCOME, SCHOOL-AGE CHILDREN

	Effects of FSP Participation on Intake from:		
Outcome	Store-Bought Foods	Restaurant-Bought Foods	Foods Obtained from Other Sources
Percentage of Food Energy from Food Source	5.1**	-3.1*	-2.0
Intake as a Percentage of the RDA			
Food energy	4.5	-2.9*	-2.3
Protein	5.1	-6.0*	-4.4
Vitamin A	-2.0	-1.8	0.5
Vitamin C	12.1	-4.2	0.2
Vitamin E	5.0	-2.1	-1.9
Vitamin B_6	7.4	-2.4*	-1.5
Vitamin B_{12}	-26.9	-6.4	-3.8
Niacin	5.3	-3.7*	-2.7
Thiamin	11.5*	-2.5	-2.6
Riboflavin	11.6*	-3.1*	-1.0
Folate	22.7*	-2.8	-0.4
Calcium	6.2*	-2.5*	-0.3
Iron	5.6	-2.9*	-2.4
Magnesium	6.6	-2.7*	-2.3
Phosphorus	6.3	-3.7*	-1.9
Zinc	3.5	-2.6*	-2.5
Percentage of Food Energy from:			
Fat	1.2	-0.4	0.9
Saturated fat	0.4	-0.5	0.9
Protein	-0.6	-0.6	0.9
Carbohydrate	-0.7	1.1	-2.2
Intake of:			
Fiber (g)	0.5	-0.3**	-0.3
Cholesterol (mg)	-9.0*	-9.0*	-1.2
Sodium (mg)	161.9	-101.1*	-89.7

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions from the three sources of nutrient intake on a series of independent variables, including food stamp benefits. Mean values of the outcomes from the three sources for all low-income individuals are shown in Appendix C. The levels of statistical significance are based on the significance level of the coefficient on the food stamp benefit variable. The full set of regression results for selected nutrients is shown in Appendix D. Standard errors for the impact estimates are shown in Appendix E.

g = grams; mg = milligrams.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

whereas the effect on vitamin and mineral intake from restaurant-bought and other foods tends to be negative (and typically statistically significant for restaurant-bought foods).

A similar pattern is found for low-income adults (Table V.12). FSP participation leads to a significant increase in the percentage of food energy obtained from store-bought foods (of about three percentage points) and a significant decrease in the percentage obtained from restaurant-bought foods (of about two percentage points). The effects on nutrient intake *levels* tend to be positive but statistically insignificant for store-bought foods and negative and significant for restaurant-bought and other foods. These effects are generally consistent across nutrients, but not in every case. For example, the effect of participation on fiber intake from store-bought foods is negative (and statistically insignificant), whereas the effect on sodium intake from store-bought foods is positive, significant, and fairly large. This suggests that the additional foods adults obtain from stores as a result of FSP participation tend to be low in fiber and high in sodium. These effects also are consistent with the overall effects of participation on intake of these dietary components among low-income adults. For example, the combination of the negative effect on fiber intake from store-bought foods with the negative effect on fiber intake from the other two sources leads to the negative overall effect of participation on fiber intake among low-income adults discussed earlier.

Analysis of the effect of FSP participation on where individuals obtain their foods and nutrients shows that food stamps lead households to purchase more food from stores than they would have without food stamps. Although the actual diets of preschoolers in these households are not greatly affected by this change, school-age children and adults who live in food stamp households end up consuming a larger proportion of their food energy from these store-bought foods. However, households compensate for the additional food they get from stores by going out to eat a little less often and by getting food from other sources a little less often.

TABLE V.12

EFFECT OF FOOD STAMP PARTICIPATION ON NUTRIENT INTAKE,
BY WHERE FOODS WERE OBTAINED:
LOW-INCOME ADULTS

	Effect of FSP Participation on Intake from:		
Outcome	Store-Bought Foods	Restaurant-Bought Foods	Foods Obtained from Other Sources
Percentage of Food Energy from Food Source	2.8*	-2.4**	-0.9
Intake as a Percentage of the RDA			
Food energy	2.4	-1.7	-1.0
Protein	4.8	-3.4*	-2.1
Vitamin A	1.4	-2.7*	-2.2*
Vitamin C	9.3	-3.0*	-3.1*
Vitamin E	-0.7	-2.0**	-1.2
Vitamin B_6	2.5	-2.6*	-1.3*
Vitamin B_{12}	4.6	-23.5*	-5.9
Niacin	1.9	-2.7	-1.6
Thiamin	4.7	-2.5*	-1.5
Riboflavin	3.4	-2.3	-1.4
Folate	1.0	-2.5*	-1.4
Calcium	2.4	-1.8*	-0.9
Iron	1.4	-3.0	-1.7
Magnesium	0.1	-1.9**	-1.2*
Phosphorus	3.2	-3.0*	-1.8*
Zinc	4.6	-2.4*	-1.2*
Percentage of Food Energy from:			
Fat	0.6	0.2	-1.2
Saturated fat	0.5*	-0.1	-0.6
Protein	0.2	-0.2	0.0
Carbohydrate	-0.6	1.0	3.1
Intake of:			
Fiber (g)	-0.4	-0.4**	-0.2
Cholesterol (mg)	20.3*	-8.2	-5.2*
Sodium (mg)	222.1**	-77.0	-40.3

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals and Diet and Health Knowledge Survey (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions from the three sources of nutrient intake on a series of independent variables, including food stamp benefits. Mean values of the outcomes from the three sources for all low-income individuals are shown in Appendix C. The levels of statistical significance are based on the significance level of the coefficient on the food stamp benefit variable. The full set of regression results for selected nutrients is shown in Appendix D. Standard errors for the impact estimates are shown in Appendix E.

g = grams; mg = milligrams.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

2. Effects Among Subgroups of the Low-Income Population

Different groups of low-income individuals may respond differently to participation in the FSP program. Earlier parts of this chapter have presented estimates of program effects on food and nutrient intake separately for preschoolers, school-age children, and adults. However, other, additional factors may be related to how participation affects intake. In particular, factors related to what individuals normally eat or related to their attitudes concerning what they eat may lead to differences in the way food stamps affect their diets.

This section presents estimates of the influence of FSP participation on nutrient intake for subgroups of the populations of low-income preschoolers, school-age children, and adults. It examines subgroups defined by these individuals' age and gender, race/ethnicity, health status, income, and (for adults) dietary attitudes.[9] Tables V.13 through V.15 present the subgroup estimates.

Overall, the estimated effects of FSP participation on nutrient intake do not vary greatly by subgroup, and there are few subgroups for which participation leads to significantly higher nutrient intake across a range of nutrients.[10] There are some differences, however, in the estimated effects of participation for selected subgroups, such as the race/ethnicity and income subgroups.

Among preschoolers, FSP participation leads to significantly higher intake of vitamin C, thiamin, magnesium, and sodium among Hispanics (Table V.13). For a number of other nutrients, there are positive but statistically insignificant effects. For non-Hispanic blacks and

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[9]This study also examined several other subgroups, including those defined by household type; participation in the AFDC, WIC, NSLP, and SBP programs; family shopping patterns; and the food security status of the family. No systematic differences were found in the estimated effects of FSP participation on nutrient intake for any of these subgroups.

[10]Because of smaller sample sizes in the subgroup analysis, significance levels are examined using the 1, 5, and 10 percent confidence levels.

TABLE V.13

EFFECTS OF FSP PARTICIPATION ON NUTRIENT INTAKE FOR SUBGROUPS OF THE LOW-INCOME POPULATION: PRESCHOOLERS

	Effect of FSP Participation on Intake (as Percent of RDA) of:																	
Subgroup	Food Energy	Vitamin A	Vitamin C	Vitamin E	Vitamin B_6	Vitamin B_{12}	Niacin	Thiamin	Riboflavin	Folate	Calcium	Iron	Magnesium	Phosphorus	Zinc	Fiber	Cholesterol	Sodium
Age																		
Age 1	5.2	-19.5	10.6	3.2	-5.4	-34.4	-3.9	-1.1	1.3	-31.9	-0.7	-6.6	3.8	0.9	1.1	0.3	13.3	-28.4
Age 2	-2.3	-32.6	-12.7	-2.6	-15.0[a]	-125.9[a]	-8.1	-8.6	-21.6*	-57.1*	-8.2	-12.4	-12.6	-11.2	-4.2	-0.3	-19.6	-25.5
Age 3	-3.9	-20.5	28.0	-12.2	-8.8	-33.1	-8.3	-8.5	-3.2	14.9	-3.2	-14.2	-15.7	-10.8	-5.1	-1.3[a]	-37.4[a]	-143.1
Age 4	0.5	-6.8	-3.7	-2.1	-7.4	18.9	-4.5	-14.4	-4.9	-20.0	-3.2	-9.3	-1.8	0.4	-3.9	-0.2	-4.5	-92.4
Gender																		
Female	0.9	-5.4	-0.5	-2.6	-13.5	-4.5	-13.2[a]	-8.8	-4.7	-27.3	-3.1	-14.6*	-7.3	-3.9	-6.4	-0.3	-7.8	-11.5
Male	-0.8	-34.3*	10.3	-3.6	-5.3	-86.4	0.2	-6.8	-9.7	-23.6	-4.6	-6.8	-5.5	-6.4	0.4	-0.3	-14.4	-120.3
Race/Ethnicity																		
Hispanic	10.0	-20.9	69.6*	-1.5	10.8	-105.8	18.5	21.4[a]	3.4	38.9	1.2	-4.4	23.9[a]	11.5	7.1	1.0	-16.7	292.6[a]
Black	2.6	-54.5*	-30.8	5.4	-19.1*	-120.0	-14.3	-10.0	-7.0	-51.1[a]	-1.3	-16.7*	-7.5	1.0	-0.5	-0.4	-14.1	-9.1
White/ Other	-4.1	-5.6	2.7	-7.5	-10.7	0.7	-10.0	-15.2*	-10.6	-32.9	-6.4	-9.8	-14.7[a]	-12.8	-6.8[a]	-0.7	-8.2	-200.7*
Health Status																		
Excellent	-4.8	-27.7[a]	21.5	-6.3	-14.3*	-92.9[a]	-12.8[a]	-11.3	-11.9	-25.3	-6.8	-12.4*	-15.8[a]	-15.1[a]	-6.6[a]	-0.7	-27.2*	-159.6
Very Good	10.0*	-17.9	-37.3	17.0*	3.5	-40.2	10.7	-0.1	0.5	-15.8	-2.6	-4.6	8.6	7.5	9.6	0.7	6.4	95.9
Good	0.1	-1.9	5.4	-20.7*	-16.3	103.2	-12.9	-4.6	0.0	-46.4	5.5	-13.5	0.7	11.0	-8.4	-0.4	20.9	38.8
Fair/Poor	0.5	-4.7	55.4	-26.2	4.7	-11.3	1.8	-20.3	-22.2	-10.3	-5.7	-12.1	0.1	-10.8	-11.5	-0.8	-24.4	-269.9
Income Level ($ per person per month)																		
< 200	5.5	-14.9	34.4[a]	8.0	1.9	-0.8	6.1	3.8	-3.2	8.5	-4.2	-7.0	6.3	2.2	3.6	0.8	-2.3	65.5
200-400	-2.9	-20.4	-23.3	-12.4[a]	-16.2*	-45.2	-15.1[a]	-15.7[a]	-8.8	-48.3[a]	-3.5	-13.7*	-14.9	-8.3	-7.3	-0.9	-7.9	-103.6
> 400	-18.3[a]	-29.9	-4.6	-21.4	-34.5*	-112.9	-42.7*	-39.2*	-18.4	-124.7*	-4.0	-21.4	-31.5	-31.1	-19.2*	-3.0	-53.0[a]	-721.6

SOURCE: 1994-1996 CSFII.

NOTE: Estimates based on difference between the regression-adjusted mean value of the outcome variable for participants and the regression-adjusted mean for nonparticipants among members of the relevant subgroup. The regression model used to generate these estimates was an OLS model that included an interaction between FSP benefits and the subgroup of interest.

[a]Significantly different from zero at the .10 level, two-tailed test.
*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

TABLE V.14

EFFECTS OF FSP PARTICIPATION ON NUTRIENT INTAKE FOR SUBGROUPS OF THE LOW-INCOME POPULATION:
SCHOOL-AGE CHILDREN

	Effect of Participation on Intake (as Percent of RDA) of:																	
Subgroup	Food Energy	Vitamin A	Vitamin C	Vitamin E	Vitamin B_6	Vitamin B_{12}	Niacin	Thiamin	Riboflavin	Folate	Calcium	Iron	Magnesium	Phosphorus	Zinc	Fiber	Cholesterol	Sodium
Age/Gender																		
Age 5-6	4.4	7.3	17.3	5.5	9.4	-17.4	5.5	15.5[a]	15.5[a]	44.0**	9.2[a]	1.9	11.0[a]	14.1[a]	0.2	0.1	9.9	124.1
Age 7-10	-3.1	1.0	-9.3	0.7	-0.4	-58.4	-5.1	-3.9	1.1	7.0	1.4	-4.8	-2.9	-0.3	-5.4	-0.9	-11.2	-126.2
Females 11-14	5.4	-23.6	12.4	5.4	0.7	-129.8	4.0	8.7	4.4	8.1	1.3	1.8	4.0	0.6	-0.3	-0.1	-22.4	120.3
Females 15-18	-12.4*	-0.3	5.1	3.1	-6.7	-8.7	-19.2[a]	-1.3	-2.8	17.4	-5.0	-11.8	-7.4	-12.2	-8.1	-1.2	-0.4	-588.6*
Males 11-14	-3.6	-31.0	32.5	-13.4[a]	-0.6	-44.2	-3.5	3.9	6.5	12.0	-0.9	10.9	3.6	-0.8	-1.2	0.1	32.5	-17.0
Males 15-18	-3.0	6.5	10.9	-8.4	2.1	6.0	-2.7	-0.7	-0.4	-0.8	-3.3	-0.5	-4.9	-10.7	-3.6	0.3	-13.0	9.6
Race/Ethnicity																		
Hispanic	-0.2	9.9	24.2	3.1	5.1	-132.2[a]	2.9	11.5	4.4	36.7**	0.9	0.7	-2.4	-6.3	-1.2	-0.4	-6.7	-87.1
Black	-3.2	-27.3*	-3.4	-8.5[a]	-4.0	-108.4	-6.1	-2.9	-2.1	12.3	-4.5	-4.8	1.9	-1.5	-2.3	-0.1	-12.7	-105.7
White/Other	0.2	5.8	7.7	5.7	4.4	69.1	-2.6	5.2	12.4	9.9	8.3[a]	1.6	4.6	9.1	-4.5	-0.4	12.3	16.3
Health Status																		
Excellent	0.4	-29.4*	22.5	-6.3	2.7	-92.9[a]	-12.9[a]	-11.3	-11.9	22.6[a]	1.1	-0.5	-15.8[a]	-15.1	-4.7	-0.7	-27.2*	-159.6
Very Good	-0.7	23.3	-0.8	17.0*	3.7	-40.2	10.7	-0.1	0.5	18.9	3.7	4.7	8.6	7.5	2.1	0.7	6.4	95.9
Good	-4.2	13.8	-5.5	-20.7*	-0.1	103.2	-12.9	-4.6	0.0	8.8	1.8	-7.8	0.7	11.0	-4.3	-0.8	20.9	38.8
Fair/Poor	-2.9	-8.4	2.5	-26.2	-6.2	-11.3	1.8	-20.3	-22.2	9.2	2.3	-6.0	0.1	-10.8	-9.8	-0.4	-24.4	-269.9
Income Level ($ per person per month)																		
< 200	1.3	-2.5	22.1	8.0	5.9	-0.8	6.1	3.8	-3.2	22.9*	3.5	-2.3	6.3	2.2	0.4	0.8	-2.3	65.5
200-400	-4.4	-5.6	-10.9	-12.4[a]	-4.2	-45.2	-15.1[a]	-15.7[a]	-8.8	11.4	0.4	-0.9	-14.9	-8.3	-7.8[a]	-0.9	-7.9	-103.6
> 400	-20.8*	21.4	-20.9	-21.4	-12.1	-112.9	-42.7*	-39.2*	-18.4	4.3	-7.3	-31.8[a]	-31.5	-31.1	-18.3	-3.0**	-53.0[a]	-721.6**

SOURCE: 1994-1996 CSFII.

NOTE: Estimates based on difference between the regression-adjusted mean value of the outcome variable for participants and the regression-adjusted mean for nonparticipants among members of the relevant subgroup. The regression model used to generate these estimates was an OLS model that included an interaction between FSP benefits and the subgroup of interest.

[a]Significantly different from zero at the .10 level, two-tailed test.
*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

TABLE V.15

EFFECTS OF FSP PARTICIPATION ON NUTRIENT INTAKE FOR SUBGROUPS OF THE LOW-INCOME POPULATION: ADULTS

	Effect of Participation on Intake (as Percent of RDA) of:																	
Subgroup	Food Energy	Vitamin A	Vitamin C	Vitamin E	Vitamin B_6	Vitamin B_{12}	Niacin	Thiamin	Riboflavin	Folate	Calcium	Iron	Magnesium	Phosphorus	Zinc	Fiber	Cholesterol	Sodium
Age/Gender																		
Females 19-24	-1.5	-19.5	-5.0	-13.7[a]	-4.6	-54.2	-2.2	-5.9	-4.6	3.5	-8.2	-6.7	-6.6	-12.1	-4.2	-1.2	-4.1	-47.9
Females 25-50	2.9	9.0	16.5	3.1	4.9	9.1	3.4	6.5	5.4	2.3	1.6	-1.3	0.2	3.4	0.5	-0.2	-6.6	89.6
Females 51-64	-2.3	-9.1	-5.4	-7.3	-2.4	6.1	-1.6	-4.7	-3.5	-6.1	-2.2	-10.0	-1.0	0.2	1.3	-1.1	21.5	-45.2
Females 65+	0.1	-35.8	-21.1	-0.4	-14.1[a]	-54.9	-13.8	-17.5[a]	-9.6	-19.1	-2.3	-6.6	-6.6	-9.3	1.3	-1.6	34.1	26.5
Males 19-24	2.7	3.8	-37.0	-7.6	-5.8	-27.4	-4.0	3.3	1.6	-8.9	-5.2	2.3	-0.8	1.8	-10.0	-2.2	82.7	584.4
Males 25-50	-1.3	-12.7	-4.9	-10.3*	-3.3	-53.6	-2.3	5.2	1.9	-9.1	2.5	-1.8	-4.4	-2.3	8.4	0.4	1.7	160.5
Males 51-64	-1.2	36.2[a]	32.3[a]	-1.7	3.0	37.6	-2.8	9.6	2.9	12.9	-0.7	9.1	-3.6	-4.4	-6.4	-2.4	4.1	259.9
Males 65+	-1.3	-12.7	-4.9	11.0	-3.3	-41.3	15.2	3.8	3.8	-9.1	2.5	-1.8	-2.8	-6.4	8.4[a]	-1.5	-0.1	391.2
Race/Ethnicity																		
Hispanic	-0.9	-21.1	3.4	3.0	-2.6	-49.5	0.1	5.2	-4.8	-7.5	-6.0	-3.8	-4.2	-9.4	1.8	-1.7*	-5.0	143.0
Black	7.0*	-1.4	16.2	-0.2	1.7	-12.6	7.0	9.4	8.3	6.5	5.8[a]	11.9*	1.7	11.2[a]	5.2	0.5	8.1	430.8*
White/Other	-2.7	2.6	-5.2	-7.5*	-1.4	-7.8	-4.6	-3.1	0.1	-6.1	-0.7	-10.0*	-4.3*	-5.3	-0.9	-1.3**	11.4	-18.7
Health Status																		
Excellent	1.0	-2.2	22.9	0.1	-1.2	-69.0	-1.1	8.0	-3.5	-6.6	-2.4	-5.5	-1.9	-4.9	-1.4	-1.2	6.3	15.4
Very Good	4.9	-4.5	-7.3	-8.3	2.4	15.2	5.8	7.3	12.9*	-0.6	7.1[a]	12.0[a]	-2.0	9.0	7.1	-0.8	34.3[a]	368.8*
Good	-1.0	-16.1	9.4	-4.7	-2.2	-63.3	-3.6	-0.3	-5.4	-3.8	-2.7	-4.5	-3.1	-7.1	0.5	-0.8	-8.1	56.5
Fair	1.1	15.3	-6.0	2.6	3.3	56.5	5.5	3.5	8.2	-2.0	-1.2	-6.1	-2.0	1.7	2.7	-0.8	34.1*	202.9
Poor	-7.1	-12.9	-3.1	-11.0	-9.8[a]	-62.1	-15.0*	-10.5	-10.8	-4.0	-1.2	-10.3	-5.7	-10.4	-5.6	-1.4	-48.7*	-56.5
Income Level ($ per person per month)																		
< 200	-3.7	1.2	-10.8	-7.4	-4.5	20.3	-5.1	-1.0	-1.5	-12.6*	-4.6	-10.3*	-7.9*	-9.0[a]	-1.6	-2.5**	4.9	5.3
200-400	1.9	-7.2	8.1	-1.8	-0.8	-60.5	1.9	2.4	0.9	1.3	1.2	-0.2	-2.2	-2.7	0.8	-0.7	3.5	229.1*
> 400	2.2	-4.1	15.2	-1.8	2.5	2.2	0.2	2.7	3.3	1.9	3.5	1.7	3.4	6.9	4.1	0.8	12.3	139.9
Diet-Disease Relation Awareness																		
Low awareness	-0.5	23.8*	15.6	-2.3	1.4	59.8	1.5	6.0	7.0	2.0	-1.5	-2.0	-5.1*	-4.1	0.5	-1.1	10.8	59.1
High awareness	-0.9	-16.9[a]	-1.6	-4.7	-3.1	-48.8	-3.7	-2.4	-3.2	-7.7	0.3	-3.2	-3.3	-2.3	1.3	-1.2**	7.1	126.2
Nutrition Importance Attitudes																		
Low importance	1.2	1.6	7.6	-0.7	3.8	-15.6	4.7	7.7[a]	7.1	1.0	2.4	-1.2	-3.0	1.3	2.5	-0.6	6.3	276.9*
High importance	-2.2	-14.5	6.2	-4.1	-6.4[a]	-86.0*	-7.6	-3.4	-9.5*	-8.3	-4.6	-7.5	-3.6	-9.1[a]	-1.6	-1.1	4.6	-42.3

TABLE V.15 *(continued)*

SOURCE: 1994-1996 CSFII.

NOTE: Estimates based on difference between the regression-adjusted mean value of the outcome variable for participants and the regression-adjusted mean for nonparticipants among members of the relevant subgroup. The regression model used to generate these estimates was an OLS model that included an interaction between FSP benefits and the subgroup of interest.

[a]Significantly different from zero at the .10 level, two-tailed test.
*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

whites, the estimated effects of participation are more likely to be negative, and several are statistically significant.

The other major characteristic related to the effects of FSP participation for preschoolers is income. The estimated effects of participation on nutrient intake are much more likely to be negative and significant among preschoolers with higher household income levels. Among the low-income preschoolers with the highest income levels, participation is negatively and significantly related to intake of food energy, vitamin B_6, niacin, thiamin, folate, zinc, and cholesterol. Among those with the lowest income levels, participation does not have a significant negative effect on the intake of any nutrient examined, and it has a significant positive effect on the intake of vitamin C.

The patterns of effects by income are similar among school-age children. For the higher-income group, participation has a significant negative effect on the intake of food energy, niacin, thiamin, iron, fiber, sodium, and cholesterol (Table V.14). For the lower-income group, participation has a significant positive effect only on the intake of folate.[11] The effects of race/ethnicity for school-age children are similar to those for preschoolers, albeit smaller and less significant.

Subgroup impacts among adults differ from those of preschoolers and school-age children in two respects. First, the effects of FSP participation among the income subgroups for adults are the reverse of those for children. For low-income adults, those in the lowest household income group tend to have the most negative effects. In particular, participation is estimated to negatively and significantly influence intake of folate, iron, magnesium, phosphorus, and fiber among the lowest-

[11]For school-age children, there are two additional subgroups for which there are systematic FSP effects. Among children ages five or six, FSP participation is estimated to positively and significantly affect the intake of thiamin, riboflavin, folate, calcium, magnesium, and phosphorus; none of the other age/gender subgroups have a systematic set of effects such as this. In addition, participation has a significant negative effect on the intake of a number of nutrients for those school-age children reported to be in excellent health.

income group, while, in most cases, not affecting significantly nutrient intake for the other income groups (Table V.15).

Among the racial/ethnic subgroups for adults, the results again differ from those for children. FSP participation is most likely to positively and significantly affect nutrient intake among blacks, with significant positive effects on intake of food energy, calcium, iron, thiamin, phosphorus, and sodium. In contrast, the effects among whites are negative and significant for vitamin E, iron, magnesium, and fiber.

Overall, the subgroup analysis shows little systematic evidence of positive effects of FSP participation on nutrient intake among key subgroups of the low-income population. The estimated effects of participation differ across a few subgroups, but there are few subgroups for which the estimated effect on the intake of vitamins and minerals is consistently positive and significant. Furthermore, these estimated subgroup effects often are not consistent across the three age groups examined.

3. Alternative Model Specifications

If the basic model used to estimate the effects of FSP participation on nutrient intake is misspecified, then the finding that participation has a statistically insignificant effect on intake may be biased. To test the basic model specification, alternative specifications were estimated that relaxed specific assumptions of the basic model. In particular, the following alternative specifications were estimated:

1. Test the sensitivity of the results to estimation of a nonlinear specification of the effect of food stamp benefits on nutrient intake.

2. Test the sensitivity of the results to the inclusion of variables such as a person's body mass index (BMI), which is potentially endogenous.

3. Allow FSP participation and the other independent variables to influence nutrient intakes differently in different parts of the distribution.

4. Examine the sensitivity of the models to estimation with sample weights.

5. Estimate models based on a sample that excludes nonparticipants who may have been ineligible for the FSP.

The purpose of estimating these alternative specifications of the basic model was to determine whether the results changed qualitatively with relaxation of any key assumptions (that is, whether the results were not robust), thus suggesting potential misspecification.

a. Nonlinear Effects of Food Stamp Benefits

In the basic model specification, it was assumed that each additional dollar of food stamp benefits has the same effect on nutrient intake, regardless of the total benefit amount paid out prior to that dollar. Thus, the total effect of $100 in benefits will be exactly twice the total effect of $50 in benefits. It is possible, however, that the true effect of food stamp benefits on nutrient intake is nonlinear. For example, households receiving small benefit levels may view their food stamp coupons as too inconsequential to influence their consumption patterns, whereas households receiving larger benefit levels may increase (or change in some other way) their food consumption in response to additional resources. Alternatively, a household might use its food stamp coupons to raise its food consumption to a desired level (assuming its cash income alone is insufficient to do this) but subsequently use benefit dollars for other purposes (by substituting food stamp coupons for dollars it would otherwise have spent on food) once its desired food consumption level was reached. In either case, the effect of benefit dollars on nutrient intake would be nonlinear.

We estimated a nonlinear version of the basic model that included a quadratic specification of the FSP benefit amount (where food stamps were represented by a benefit amount variable and a benefit amount squared variable).[12] The estimation results of the quadratic model presented in the first two columns of Table V.16 indicate that food stamp benefits are not generally related to nutrient intake in a nonlinear way. For the selected nutrients examined, the quadratic (or squared) term is statistically significant in only two cases, and it is not systematically positive or negative for low-income preschoolers, school-age children, or adults.[13]

Another way of measuring the effect of FSP participation without making assumptions about the linearity of the effect of benefit dollars is to leave food stamp benefits out of the specification entirely. In particular, the inclusion of a single binary variable representing FSP participation will measure the average effect of participation without requiring any assumptions about the effect of each benefit dollar. In addition, any bias that arises if the actual benefit level of participants is correlated with measurement error in the household income variable or unobserved factors affecting net income (as is discussed in Chapter II) will be avoided by including the binary participation variable rather than the benefit amount. The coefficient on this variable reflects an estimate of the

[12]Estimation of this model requires strong assumptions concerning the measurement of various factors and their effects on nutrient intake. Two assumptions are particularly important. First, the model assumes that there is no measurement error in the benefit amount, household size, or household income variables. Second, the effect of FSP benefits on nutrient intake is assumed to be the same for households of different sizes and different income levels. For example, if there is no assumption that the effects of benefits on intake are the same across different types of households, there can be no distinguishing between a truly nonlinear effect of benefits and the possibility that benefits affect intake differently for households with different income levels (and, consequently, different benefit levels).

[13]Another nonlinear version of the basic model was also estimated, in which FSP benefits were represented by four dummy binary for each individual: (1) receipt of benefits in the lowest quartile (of positive benefit amounts) within the population, (2) receipt of benefits in the second quartile, (3) receipt of benefits in the third quartile, and (4) receipt of benefits in the highest quartile. The excluded group includes all individuals whose households do not receive food stamps. Estimation of this specification revealed no systematic patterns of nonlinear FSP effects.

TABLE V.16

EFFECTS OF FOOD STAMP BENEFITS ON NUTRIENT INTAKE, NONLINEAR SPECIFICATIONS
(Low-Income Individuals)

	Quadratic Model			
Nutrient	Coefficient on Benefit Variable	Coefficient on Benefit-Squared Variable	Binary Participation Model (Estimated Effect of Participation)	Basic Linear Model (Estimated Effect of Participation)
Preschoolers				
Intake as a percentage of the RDA:				
Food energy	-0.12	0.0014	-4	0
Vitamin A	-0.60	0.0032	-28*	-20
Vitamin C	0.09	-0.0002	-4	6
Vitamin B_6	-0.37	0.0026	-14*	-9
Calcium	-0.14	0.0007	-9	-5
Iron	-0.33	0.0019	-12*	-10*
Zinc	-0.13	0.0010	-4	-3
Fat as a percent of food energy	0.01	-0.0001	-0.1	-0.1
School-Age Children				
Intake as a percentage of the RDA:				
Food energy	0.04	-0.0007	1	-1
Vitamin A	-0.23	0.0021	-5	-4
Vitamin C	0.07	0.0009	11	9
Vitamin B_6	-0.01	0.0005	3	1
Calcium	0.13	-0.0011	5	3
Iron	0.08	-0.0011	2	-1
Zinc	0.07	-0.0014	-1	-3
Fat as a percent of food energy	0.03	-0.0004	0.7	0.1
Adults				
Intake as a percentage of the RDA:				
Food energy	0.13	-0.0015	2	0
Vitamin A	0.36	-0.0048	3	-3
Vitamin C	-0.10	0.0018	0	3
Vitamin B_6	-0.06	0.0005	-1	-1
Calcium	0.10	-0.0012	1	-1
Iron	0.08	-0.0016	-1	-3
Zinc	0.03	-0.0002	2	1
Fat as a percent of food energy	-0.00	0.0001	0.0	0.2
Sample Size				
Preschoolers	**785**	**785**	**785**	**785**
School-Age Children	**926**	**926**	**926**	**926**
Adults	**2,224**	**2,224**	**2,224**	**2,224**

SOURCE: 1994-1996 CSFII.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

effect of participation on nutrient intake based only on a comparison of FSP participants with nonparticipants--not based on comparisons between participants with different benefit levels.

Estimation of the specification that includes the single binary participation variable for a subset of nutrients does not change the basic conclusion that there is little evidence of a positive effect of participation on the intake of vitamins and minerals (Table V.16). For school-age children and adults, the estimated effects of participation on the intake of these nutrients, both in the basic model and in this version of the model, are statistically insignificant. For preschoolers, two of the estimated negative effects (on intake of vitamins A and B_6) in the basic model become statistically significant (and remain negative) in this version of the model.

b. Inclusion of Potentially Endogenous Variables

When the basic model was estimated, two sets of variables were excluded that potentially reflect important characteristics influencing individuals' food and nutrient intake: (1) a set of variables indicating the person's BMI, and (2) measures of the person's perceived micronutrient and perceived macronutrient susceptibility. Not only do these measures potentially influence nutrient intake, they also are related to individuals' FSP participation status. In particular, as discussed in Chapter III, FSP participants tend to have higher BMI levels and greater perceived susceptibility than do nonparticipants.

These variables, however, were excluded from the basic model specification because they are potentially endogenous: not only might they have an influence *on* nutrient intake, but they might be influenced *by* nutrient intake. In particular, having high nutrient intake levels may lead (in part) to a person having a high BMI value. Similarly, individuals may believe that they consume too much fat or too little vitamin C (that is, have high perceived susceptibility) because they do consume too much fat or too little vitamin C. If true, including these endogenous variables in the basic model will lead to biased estimates of their effects on nutrient intake, along with the estimates of the effect of any other variable correlated with these endogenous variables.

The alternative argument is that, because these variables primarily represent exogenous individual characteristics, it is important to control for these characteristics in estimating the effect of FSP participation on dietary intake. One could argue, for example, that perceived susceptibility primarily represents a dietary attitude that is not directly influenced by a person's actual intake levels. Under this scenario, a failure to control for perceived susceptibility may lead to biased estimates of the effect of participation on intake.

We generally accept the argument that these variables are potentially endogenous and should not be included in the basic model. However, alternative versions of the model included a set of dummy variables representing BMI (for school-age children and adults), as well as individuals' perceived micronutrient susceptibility and perceived macronutrient susceptibility (for adults only). In these models, inclusion of these variables had little influence on the estimated effect of FSP participation on nutrient intake, which generally remained statistically insignificant. The basic results are robust to the inclusion of these potentially endogenous variables. The estimated effects of BMI and the perceived susceptibility variables on nutrient intake tended to be small in magnitude, sometimes being statistically insignificant and sometimes significant.

c. Food Stamp Effects on the Nutrient Intake Distribution

To determine the effect of FSP participation on the intake of particular dietary components (either in absolute terms or relative to the RDA values), the basic model was estimated using OLS regression techniques. The coefficient on the food stamp benefits variable in this model represents the influence of benefits on the mean intake level of a particular nutrient. The implication of the estimate is that this effect is uniform across the nutrient intake distribution; in other words, FSP participation has the same effect on nutrient intake among those whose intake is low as it does among those whose intake is high.

The true effect of FSP participation may not be uniform across the nutrient intake distribution, however. In particular, among those whose usual intake is low, participation may boost intake. Among those whose usual intake is high, the effect of participation may be smaller or nonexistent. OLS regression techniques cannot capture this type of nonuniform effect across the intake distribution. Furthermore, if such nonuniform effects exist, the estimate of the effect of FSP participation on mean nutrient intake may be misleading: a statistically insignificant effect on the mean might "hide" a statistically significant effect on some portion of the nutrient intake distribution.

To account for potential differential effects of FSP participation on different parts of the nutrient intake distribution, we estimated quantile regression models (see Koenker and Bassett 1978). Quantile regression models generate estimates of the effects of the independent variables of the model (for example, food stamp benefits) on a given percentile of the distribution of the dependent variable (for example, the 25th percentile of the nutrient intake distribution). We estimate quantile regression models for selected nutrients using as dependent variables the 5th, 10th, 25th, 50th, 75th, and 90th percentiles.

A major drawback of using the quantile regression model with CSFII data is that it provides estimates of the effects of FSP participation on the distribution of nutrient intake measured over two days rather than on the usual nutrient intake distribution. Although it would be desirable to measure FSP effects on usual intake, only two days of nutrient intake data were available. As discussed in Chapter II, these two days of nutrient intake data can provide an unbiased estimate of the *mean* intake of a particular nutrient but not of the full distribution of the intake of that nutrient. In general, the two-day mean intake distribution has greater variance than the distribution of usual intake. In turn, the estimated effect of FSP participation on the 25th percentile of the two-day mean intake distribution is not the same as the relationship actually of interest--the effect of participation on the 25th percentile of the usual intake distribution. Despite this drawback, the set of quantile regression models constitutes a useful piece of exploratory analysis for determining whether there are any systematic nonuniform effects of FSP participation on the intake distribution for selected nutrients.

Table V.17 presents estimates of the effects of participation on various percentiles of the two-day distribution listed above for eight dietary components. This analysis reveals no evidence that the OLS regression estimates of the insignificant effect of FSP participation on the mean intake of most nutrients are hiding significant effects that vary across the intake distribution. In particular, the quantile regression estimates include few statistically significant effects of participation on any of the percentiles of the intake of any of the dietary components examined. For low-income preschoolers, school-age children, and adults, the estimated effects of participation typically are statistically insignificant, and their signs and magnitudes show no systematic patterns.

d. Sample Weighting

The basic model was estimated using unweighted data, as discussed in Chapter II. The primary reason for unweighted regression models is that the stratification factors used to select the CSFII sample and create the sample weights either were directly controlled for in the regression model or were closely related to factors that were included as independent variables in the model. In this case, using sample weights in the regression is unnecessary and may needlessly reduce the efficiency of the estimates (DuMouchel and Duncan 1983).

TABLE V.17

EFFECTS OF PARTICIPATION ON DIFFERENT PERCENTILES
OF THE NUTRIENT INTAKE DISTRIBUTION
(Low-Income Individuals)

	Effects of Participation on Nutrient Intake:					
Nutrient	5th Percentile	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Preschoolers						
Intake as a percentage of the RDA:						
Food energy	0.3	-1.7	-0.7	1.8	2.3	0.3
Vitamin A	1.1	-1.8	-4.9	-6.2	-4.5	6.3
Vitamin C	-6.2	-8.1	-9.6	11.1	14.3	16.6
Vitamin B_6	-3.2	-2.4	-10.7*	-9.0	-10.4	1.7
Calcium	-9.7	-10.2	-12.6*	-3.3	-6.0	-17.9
Iron	-4.4	-0.3	-2.4	-7.5	-10.6	-24.5
Zinc	-3.9	-4.1	-3.4	-3.0	-2.7	5.3
Fat as a percent of food energy	1.2	1.1	0.8	0.1	-0.5	-0.9
School-Age Children						
Intake as a percentage of the RDA:						
Vitamin A	7.6	5.9	8.1*	7.0	4.2	11.6
Vitamin C	-8.2	-2.0	8.2	11.7	0.7	31.1
Vitamin B_6	-2.8	1.7	-0.3	0.2	0.9	3.4
Calcium	-4.3	0.2	-2.2	-2.6	-1.0	9.6
Iron	1.2	-4.1	-3.5	-4.9	5.6	-5.7
Zinc	-2.3	-5.4	-4.0	-2.4	-5.2	1.4
Fat as a percent of food energy	0.4	0.3	-0.5	0.3	0.6	-0.2
Adults						
Intake as a percentage of the RDA:						
Vitamin A	1.5	-0.6	-0.7	-4.1	-11.2	-11.4
Vitamin C	-0.8	-3.3	-1.8	1.1	10.3	6.1
Vitamin B_6	-2.4	-0.2	0.4	-1.5	0.0	1.1
Calcium	-1.7	-1.7	-1.1	1.0	0.2	2.8
Iron	2.0	-0.8	-2.3	-3.4	-5.4	-5.3
Zinc	0.7	1.1	-0.1	-1.7	2.9	2.7
Fat as a percent of food energy	1.1	1.1*	0.3	0.2	0.0	0.8

SOURCE: 1994-1996 CSFII.

NOTE: These estimation results are based on quantile regression models. The independent variables included in these models were the same as the independent variables included in the basic models.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

However, the process of selecting the CSFII sample and developing sample weights was complex; it included several steps and was based on many factors (see Tippett and Cypel 1997). Thus, it is possible that the factors that were important in determining the values of the sample weights were not controlled for sufficiently in the basic models. In this case, estimating a weighted regression might strongly affect the estimation results.[14]

To test the robustness of this study's results to the use of sample weights in the estimation process, a weighted regression model was estimated for several dietary components. The same set of independent variables were included in these models, and models were estimated using OLS regression techniques but using weighted data in the estimation process. The results are shown in Table V.18.

The use of sample weights in estimating the basic model has little influence on the estimated effects of FSP participation on nutrient intake. The coefficients on the food stamp benefits variable in the weighted and the unweighted models are very close--both in magnitude and in the level of statistical significance--for a variety of different outcomes. These results suggest that the decision not to use sample weights in estimating the basic model was appropriate.

e. Exclusion of Potentially Ineligible Nonparticipants

As noted in Chapter II, the sample used in the analysis--individuals in households with an annual income of no more than 130 percent of the poverty line--potentially includes a substantial number of nonparticipants who are not actually eligible for the FSP. In particular, the estimated FSP participation rate among the sample is 38 percent, compared with an estimated participation rate

[14]For an example of a case in which the decision whether or not to estimate a weighted regression strongly affects estimates of the dietary effects of FSP participation (using a data set other than the CSFII), see Devaney and Fraker (1989).

TABLE V.18

EFFECTS OF FSP BENEFITS ON NUTRIENT INTAKE OF LOW-INCOME INDIVIDUALS, WEIGHTED AND UNWEIGHTED REGRESSION MODELS
(Coefficient on FSP Benefits Variable)

Dependent Variable (Measured as Percentage of RDA, Except Where Noted)	Preschoolers		School-Age Children		Adults	
	Unweighted	Weighted	Unweighted	Weighted	Unweighted	Weighted
Food Energy	-0.00	0.01	-0.02	-0.06	0.00	-0.01
Vitamin A	-0.32	-0.56*	-0.06	-0.24	-0.06	-0.07
Vitamin C	0.08	-0.16	0.14	0.20	0.05	-0.09
Vitamin E	-0.05	-0.03	0.01	-0.02	-0.06	-0.12
Vitamin B_{12}	-0.74	-1.44	-0.71	-1.78	-0.32	-0.75
Calcium	-0.07	-0.04	0.04	0.01	-0.01	-0.04
Iron	-0.16*	-0.19*	-0.01	0.03	-0.05	-0.14
Zinc	-0.04	-0.03	-0.05	-0.08	0.02	-0.03
Fiber (g)	-0.01	-0.01	-0.01	-0.00	-0.02*	-0.01
Cholesterol (mg)	-0.18	-0.20	-0.02	-0.22	0.12	-0.10
Sodium (mg)	-1.07	-1.46	-0.87	-2.92	2.22	-0.53
Sample Size	**785**	**785**	**926**	**926**	**2,224**	**2,224**

SOURCE: 1994-1996 CSFII.

NOTE: The sample weight used in the weighted regression was the weight that was for sample members from all three survey years who had two days of complete nutrient intake data.

g = grams; mg = milligrams.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

among eligible individuals of 71 percent in January 1994, according to Stavrianos (1997), who defined FSP eligibility more precisely, using information not available in the CSFII. Because the ineligible nonparticipants are probably more economically advantaged than eligible nonparticipants (and participants), their inclusion in this study may influence the estimated effects of FSP participation on dietary outcomes.

To test whether the estimation results are sensitive to the sample of nonparticipants used, the basic model was reestimated after excluding nonparticipants whose observable characteristics suggested that they were the most economically advantaged. In particular, nonparticipants whose financial asset holdings exceeded $2,000, or whose household income exceeded 75 percent of poverty, were excluded. The resulting FSP participation rate among this limited sample rose to 67 percent, much closer to the participation rate reported by Stavrianos (1997).[15]

Restricting the sample to this more limited group of nonparticipants does not substantially affect the estimated effects of FSP participation on nutrient intake. Among preschoolers, the estimated effects based on the limited sample are less likely to be negative and more likely to be positive than the estimated effects based on the full low-income sample (Table V.19). However, even with the limited sample, none of the seven estimated effects are statistically significant. Among school-age children, the estimated effects based on the limited sample are slightly more negative than the estimated effects based on the full sample. Among adults, there are no consistent patterns.

This test of the sensitivity of the results to the sample of nonparticipants shows no evidence that inclusion of potentially ineligible nonparticipants in the sample causes the generally insignificant

[15]We also tested samples based on 100 percent of poverty and 50 percent of poverty. The FSP participation rates for these samples differed from the rate for the 75 percent of poverty sample. The estimated effects of participation, however, were similar for the three samples.

TABLE V.19

EFFECT OF PARTICIPATION ON NUTRIENT INTAKE USING ALTERNATIVE SAMPLES OF NONPARTICIPANTS

	Estimated Effect of Participation					
	Preschoolers		School-Age Children		Adults	
Intake as a Percentage of the RDA	Full Low-Income Sample	Limited Low-Income Sample	Full Low-Income Sample	Limited Low-Income Sample	Full Low-Income Sample	Limited Low-Income Sample
Food Energy	0	5	-1	-2	0	-1
Vitamin A	-20	-11	-4	-9	-3	-6
Vitamin C	5	26	9	3	3	3
Vitamin E	-3	6	0	-2	-4	-3
Iron	-10*	-7	-1	-6	-3	-1
Zinc	-3	2	-3	-5	1	3
Fat as a Percent of Food Energy	-0.1	-0.0	0.1	0.3	0.2	0.5
Sample Size	**785**	**539**	**926**	**598**	**2,224**	**1,052**

SOURCE: 1994-1996 CSFII.

NOTE: The limited low-income sample excluded nonparticipants living in households with more than $2,000 in financial assets or with income exceeding 75 percent of the poverty line.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

estimated effect of FSP participation. On the other hand, the possibility cannot be ruled out that unobserved indicators of economic prosperity among nonparticipants may be leading to the lack of estimated effects.

VI. DISCUSSION OF FINDINGS

This report examines the diets of the low-income population and the relationship between Food Stamp Program (FSP) participation and the nutritional quality of dietary intake. Data from the Continuing Survey of Food Intakes by Individuals (CSFII) show that on average, low-income persons consume sufficient amounts of most vitamins and minerals but typically fail to meet dietary requirements for limiting intake of fat and sodium. Furthermore, although the average low-income person consumes enough vitamins and minerals, substantial fractions do not get enough of selected vitamins and minerals.

The picture of low-income individuals' dietary knowledge and attitudes is mixed as well. Low-income adults appear to possess a moderate amount of nutrition knowledge and reasonably positive attitudes toward nutritious dietary practices. However, there remains substantial room for improvement in this dietary knowledge or awareness in the low-income population, including low-income FSP participants. Thus, there appears to be a useful role for the increasing effort of the FSP to provide nutrition education for participants.

The study finds that, compared with low-income nonparticipants, FSP participants shift their consumption toward foods they buy in food stores and away from foods they buy from restaurants or obtain from other sources. This suggests that food stamp benefits are being used in food stores as designed and influence the pattern of food purchasing among food stamp households. Given that low-income households obtain most of the food they eat from food stores, this findings also suggests that food stores are a potential site in which to reach FSP participants with nutrition education efforts.

There is no evidence, however, that FSP participation is associated with overall increases in individuals' food and nutrient intake. In general, participation is not significantly related to the intake of the major food groups and key nutrients and other dietary components. These findings are based on the estimation of regression models that examine the relationship between participation and intake after controlling for a wide variety of personal, environmental, survey-related characteristics, as well as individuals' dietary knowledge and attitudes. These models did not attempt to control for unobserved differences between participants and low-income nonparticipants.

The finding that food stamps are not significantly related to food and nutrient intake is somewhat surprising, from at least two perspectives. First, economic theory argues that, so long as food is a "normal good,"[1] then the increase in resources that food stamps represent should lead to an increase in food consumption.[2] In other words, because households basically are getting more money to spend on food, one would expect individuals in those households to spend more on food and, thus, consume more food (unless their increase in spending goes entirely toward purchasing either higher quality food or more convenience foods). Second, previous research consistently found that food stamps do, in fact, lead to an increase in the amount of money households spend on food and to an increase in nutrient availability (that is, the amount of nutrients available for use from their home food supplies). If households are spending more money on food and have more food in their homes, why are the individuals in those households not consuming more food?

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[1]According to economic theory, a normal good is one in which demand for the good increases as income increases.

[2]Furthermore, if the desired level of food consumption (in monetary terms) is less than the value of the food stamps (an unlikely scenario), households will be constrained to increase their food expenditures, which presumably would either lead to an increase in food intake, or to a shift in where they consume their food, or to a change in the quality of food.

This chapter discusses these issues. Section A examines whether methodological weaknesses might explain the study findings. Section B evaluates the findings in the context of the literature on the effects of FSP participation on food expenditures, nutrient availability, and nutrient intake. The report concludes with a brief discussion of possible future directions for food stamp research and policy.

A. POSSIBLE METHODOLOGICAL WEAKNESSES

The conclusions about the effects of FSP participation on food and nutrient intake are based on the results of the estimation of regression models in which a dependent variable reflecting food or nutrient intake as measured on two days is regressed on FSP benefits and a variety of other independent variables. Chapter V presented these estimation results, along with the results of several checks of the robustness of the model to possible misspecification. Aside from this possible misspecification bias, other methodological weakness could have influenced the estimation results. Two possible such methodological weaknesses are (1) selection bias, and (2) error in measuring individuals' food and nutrient intake.

1. Selection into the FSP Program

A major contribution of the report to the literature on the relationship between FSP participation and dietary intake is that the analysis directly controlled for dietary knowledge and attitudes of low-income adults in the estimation of this relationship. The failure of previous studies to control for dietary knowledge and attitudes was often cited as a potential source of selection bias (for example, Fraker 1990; Butler and Raymond 1996). The results of this analysis showed that the inclusion of variables representing dietary knowledge and attitudes did not substantially affect the estimates of the relationship between participation and dietary intake.

As discussed in Chapter II, however, while the basic model controlled for a variety of factors in addition to dietary knowledge and attitudes, the model did not control explicitly for selection into the FSP program based on unobserved factors. The possibility of such selection means that the estimated effect of participation may have been subject to selection bias. Thus, our typical estimates suggesting that participation does not significantly influence food and nutrient intake may have been wrong, and the true effect of participation may have been positive (or negative).

One possible source of selection into the FSP program is individuals' economic situation. Those who are going through particularly tough times economically may be most likely to enter the program. If the economic conditions of sample members' households are not sufficiently controlled for, and if these conditions influence intake, then estimates of the effect of participation on intake will be biased. The argument is that individuals who are worse off economically are more likely to participate and will also tend to have lower intake levels. In this scenario, a failure to control for these economic conditions will lead to a negative bias in estimating the effect of participation on intake; that is, the estimated effect may be statistically insignificant when the true effect is positive.

The basic model of food and nutrient intake controls extensively for individuals' economic circumstances. In particular, the model includes a quadratic specification of per-capita household income (excluding cash benefits), binary variables indicating whether the household's cash assets exceed $500 and whether someone in the household owns the home in which the sample member lives, and indicators of the per-capita value of household AFDC, WIC, NSLP, and SBP benefits. The model also includes a number of variables likely to be correlated with the economic circumstances of the individual's household (such as educational attainment).

However, variables listed above may not completely measure households' economic situations. It is possible that individuals who participate in the FSP program are worse off economically than those who do not participate, even after controlling for observable economic factors. In particular, there may be differences in the two groups' "permanent income" levels. For example, nonparticipants may believe that, even though they are out of work and their household income is currently low, they are likely to find a new job and earn more income relatively soon. On the other hand, participants with the same current economic circumstances may be quite pessimistic about their future earnings potential. This may be the reason they began receiving food stamps. If this unobserved difference in permanent income leads to a difference between the groups in food and nutrient intake, then selection bias will result.

Another potential explanation for selection into the FSP program based on unobserved factors is that health conditions or certain types of behavior may lead to FSP entry. In particular, individuals whose health is particularly poor or whose behavior (such as smoking) is likely to lead to future health problems may be directed to the FSP program, either by a doctor or through their contact with the Medicaid program. The basic model controls for individuals' self-reported health status, the incidence of specific health problems, smoking status, exercise level, and (in one of this study's alternative specifications) body mass index. These characteristics, however, may not fully control for the relevant health conditions or health-related behaviors that are related to FSP participation and that affect nutrient intake. If they do not, then selection bias will result.

Each of these potential explanations leading to selection bias is conceivable. In each case, however, we control explicitly for a variety of characteristics representing the underlying, unobserved factor. Controlling for these characteristics does not lead to a dramatic change in the estimated effect of participation on dietary intake. Thus, it is not certain that obtaining better measures of individuals' economic circumstances and health/behavioral characteristics would lead to a large change in the estimated effect.

2. Measurement of Nutrient Intake

This study confronted two potential sources of error in measuring the nutrient intake and dietary behavior of the low-income population: (1) ordinary sampling error, and (2) lack of complete information on individuals' usual dietary intake. Sampling error is an issue in all studies that attempt to generalize about a larger population (for example, the nation's low-income population) based on a sample of individuals. In this study, *sampling error* means that our estimate of the effect of FSP participation on dietary intake (as measured on two intake days) is measured with some degree of imprecision. Consequently, if the true effects of participation are relatively small, then the analysis will not have sufficient power to detect these effects.[3]

The second source of error involves *measuring usual dietary intake*. Ideally, one would like to measure individuals' *usual* dietary behavior--in particular, their usual intake of foods and nutrients. However, measuring usual food and nutrient intake requires many days of dietary intake data (a different number of days, depending on the food or nutrient of interest). The CSFII provides only two days of dietary intake data. Individuals' mean intake over those two days provides an estimate of their usual intake, but this estimate is subject to within-person sampling variability. This variability also makes it difficult to detect small effects of FSP participation on individuals' *usual* food and nutrient intake.

These sources of error might lead to decreases in the power of the analysis. In other words, they might obscure small, but important, effects of FSP participation on dietary intake. Under a reasonable set of assumptions, for example, the smallest true effect of participation on mean food energy intake that the analysis would have sufficient power to detect would be about 15 percent of

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[3]Measures of the standard errors of the estimated effects of FSP participation on dietary intake, and of the power of the analysis to detect these effects, are presented in Appendix E.

the standard deviation of food energy intake.[4] Since the standard deviation of food energy intake (as a percentage of the REA) among adults is about 30 percentage points, this "minimum detectable effect" would be about 5 percentage points. Thus, if the true effect of participation on mean food energy intake among adults were less than five percentage points, we could not be confident that the analysis would produce statistically significant estimates of this effect.

Program effects smaller than this minimum detectable effect of five percentage points may still be substantively important. For example, if the true effect of participation on mean food energy intake is three to four percentage points, this does not necessarily mean that nonparticipants' food energy intake as a percentage of the REA is three to four percentage points less than that of participants every day. An alternative scenario that could lead to the same result would be if participants consume three meals a day every day, while nonparticipants are forced to skip dinner because they do not have enough food two to three times a month.[5] The findings presented in this report do not suggest that this is the case, but the limited power of the analysis makes it impossible to rule out such effects (or effects of a similar magnitude in the opposite direction).

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[4]This statement about the minimum detectable effect of FSP participation on food energy intake uses an 80 percent standard for assessing power and a significance level of 0.05 (two-tailed test). It also uses the CSFII sample sizes of 602 adult participants and 1,622 low-income adult nonparticipants. Finally, it assumes that the value of R-squared from the regression of food energy on the independent variables of the model is 0.15, while the R-squared from a supplemental regression of participation on the remaining independent variables is 0.30.

[5]Assume that participants' usual food energy intake is 100 percent of the REA and that they typically consume 40 percent of that at dinner. If nonparticipants do not eat dinner two times every four weeks, their average food energy intake will be 97 percent of the REA. If they do not eat dinner three times every four weeks, their average food energy intake will be 96 percent of the REA.

B. RECONCILING THE FINDINGS WITH THE LITERATURE

The results of this study are consistent with most of the research on the effects of FSP participation on nutrient intake, as that research is described in Chapter I. The bulk of this research was summarized by Fraker (1990) as showing "little consistency" with respect to the signs and magnitudes of the estimated effects and as having effects unlikely to be statistically significant. The results of this study are consistent with the pattern of results reported by Fraker.

More recently, however, Rose et al. (1998), using data from the 1989-1991 CSFII, found significant positive effects of participation on the intake of a variety of nutrients among preschoolers. These results directly conflict with this study's findings for preschoolers--that FSP effects tend to be statistically insignificant and are more likely to be negative than positive. The reasons for the difference in the findings of the two studies are unclear, but they are likely to be related to the fact that the Rose et al. study and this study used different data sources covering different time periods. In particular, the response rate in the 1989-1991 CSFII was much lower than the response rate in the 1994-1996 CSFII. In addition, the underlying population of participants is likely to have changed over this period, in that the FSP caseload grew from about 20 million in 1990 to almost 27 million in 1995.

At first glance, the results of this study (and, more generally, of the literature on the effects of participation on nutrient intake) appear not to be consistent with studies of the effects of participation on food expenditures and nutrient availability. Using household-level data, these studies consistently found positive and significant effects of participation on both food expenditures and nutrient availability. If food stamps increase food expenditures and nutrient availability of households, then why do they not increase the food and nutrient intake of the individuals in those households?

Two possible explanations may account for the positive effects of participation on household food expenditures and the lack of effects on nutrient intake among individuals. First, the difference in estimated effects may be related to the fact that food expenditures are analyzed at the household level but intake is analyzed at the individual level. If food stamps lead to greater household food expenditures, it does not necessarily mean that the intake of all individuals within the household also rises. Food may be distributed unequally within the household, other individuals besides household members may consume some of the food, or some food may be wasted.[6]

The second explanation is that food stamps may lead households to purchase more expensive versions of the same types of food purchased by nonparticipating households. One way in which this could happen would be if nonparticipants are more likely than participants to obtain their food for free. If nonparticipants are more likely to get food from soup kitchens, food pantries, or friends and relatives, for example, they would end up spending less than participants on food but would not necessarily consume less. In fact, the analysis found some evidence that nonparticipants obtained a larger proportion of their food from such "other" sources than did participants (among adults and school-age children), although the magnitude of this difference was not large.

Alternatively, participating households may purchase brand-name foods rather than generic foods, purchase more expensive cuts of meat, or eat out at more expensive restaurants. In any of these cases, participating households would spend more than nonparticipating households on food,

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[6]An alternative explanation related to the difference between household-level versus individual-level analysis is that studies of the effects of participation on food expenditures may not have controlled sufficiently for household composition. Although these studies typically measured food expenditures in such a way as to account for the different food requirements of households of different sizes and with members of different ages, they did not necessarily adjust for the fact that children are more likely to consume food energy amounts at or above the REA for food energy. Because participating households are more likely than nonparticipating households to have children, these households may have to spend more on food to allow the children to reach the REA.

but participating individuals would not necessarily consume more food than nonparticipating individuals.

Because nutrient availability, like food expenditures, is measured at the household level, the differences between analyzing individual and household data may also explain why food stamps have been found to raise nutrient *availability* levels but not increase nutrient *intake* levels. An alternative explanation is that the results presented in this study actually are consistent with the results on nutrient availability. *Nutrient availability* measures the amount of food a household uses from its home food supplies. These supplies come primarily from foods purchased at food stores and exclude foods purchased and consumed at restaurants. Our results show that, for school-age children and (to a lesser extent) adults, participation leads to an increase in nutrients consumed from store-bought foods. Thus, the research shows that food stamps lead households to have more food available for use in the home (presumably foods obtained from stores) but lead individuals in these households to consume more store-bought foods. However, food stamps also lead individuals to consume fewer foods purchased from restaurants, and these two effects cancel each other out.

C. FUTURE DIRECTIONS FOR POLICY/RESEARCH

Before knowing definitively which direction food stamp policy should take to ensure that program benefits meet the program goal of "raising the level of nutrition among low-income households," additional research should address several issues raised earlier in this chapter. One priority in research should be to measure usual dietary intake as accurately as possible so that small but important effects of FSP participation can be detected. Furthermore, additional research should take a variety of approaches to determine whether selection into the program influences estimated program effects. With better data, future studies may be able to control explicitly for more precise measures of individuals' economic circumstances and health conditions than was possible in this study. Alternatively, by carefully choosing "identifying variables" that are correlated with participation but that do not directly influence intake, future studies may be able to estimate "selection bias models" that control for unobservable differences between participants and nonparticipants. For example, the following may be promising identifying variables: variables indicating the distance an individual lives from the food stamp office, ease of the administrative application process, or the extent to which social stigma is a factor in the individual's participation decision.

In addition, future research should directly address the difference between the estimated effects of FSP participation on food expenditures and nutrient availability at the household level and nutrient intake at the individual level. Why do food stamps appear to lead to increases in food expenditures and nutrient availability but not to increases in nutrient intake?

Future research should also address the question of how food stamp benefits influence households' overall expenditures. Most of the studies of the effects of food stamp benefits on food expenditures are based on relatively old data, from a period when the FSP had different program rules than the current ones. Thus, current estimates are needed on the effects of participation on food expenditures, and future research should also estimate the effects of participation on household spending on nonfood goods and services.

With this research base, FSP policy can be designed to better meet program goals. The analysis in this report provides circumstantial evidence that there is a role for increasing nutrition education and promotion among participants. The study finds that participants have "moderate" levels of nutrition knowledge--they are aware of some key aspects of the link between nutrition and health and of what constitutes good nutritional practices, but they also are unaware of other key pieces of nutritional information. These findings are consistent with Bradbard et al. (1997), who report that many participants who took part in focus groups said that they "would like help with menu planning and using information on nutrition labels, with the focus on planning appealing, nutritious meals at low cost."

There is clear room for improvement in both the dietary knowledge and dietary quality of the low-income population. As measured by knowledge of the USDA Food Guide Pyramid servings recommendations, awareness of the health consequences of specific dietary practices, and knowledge of the nutritional content of specific foods, low-income adults' dietary knowledge is below that of high-income adults. On the other hand, low-income adults agree to a large extent that following dietary guidelines is important. Forthermore, FSP participants commonly express the belief that their own diets are not as good as they should be.

Assuming that a link exists between nutritional knowledge and dietary intake (an assumption supported in part by empirical evidence), then continuing the existing program efforts at promoting nutrition education among participants may lead to an improvement in the nutritional quality of participants' dietary intake. While the additional economic resources provided by FSP benefits alone may not substantially change participants' dietary intake, perhaps these additional resources, supported by nutrition education, can help the FSP program meet its goal of raising the level of nutrition of the low-income population. The combined effect of these two components of the FSP provide participants with the tools and strategies to improve the nutritional quality of their diets.

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APPENDIX A

USING PRINCIPAL COMPONENTS ANALYSIS TO DEFINE DIETARY KNOWLEDGE AND ATTITUDE FACTORS

As described in Chapter II, we conducted principal components analysis to identify summary measures of dietary knowledge and attitudes that may be related to dietary intake. Section A of this appendix describes the overall approach to the principal components analysis and how key dietary knowledge and attitude factors were identified. Much of this methodological approach closely tracks the approach used by Haines et al. (1994) to construct dietary knowledge and attitude scales. Sections B and C provide details on the factors created and used in this study.

A. PRINCIPAL COMPONENTS METHOD

Based on theoretical considerations that suggest a given set of items which may contribute to one or more composite scales, a principal components analysis was conducted in this study to determine the appropriate number of scales (or factors) to draw from the items, along with which items should contribute to which scales. Principal components analysis identifies a set of principal components (factors) and provides "factor loadings" for each item on each of the factors. Those items that load strongly on one factor, but have relatively low loadings on other factors, are identified for inclusion in that factor.[1]

After obtaining the results of the principal components analysis, we first determined how many factors to retain, or, stated another way, how many scales are represented by a particular set of survey items. There are a variety of ways of doing this, but the scree test was relied on primarily. In this method, the analyst first generates a scree plot where the magnitude of the eigenvalues are plotted against their ordinal numbers (first eigenvalue, second eigenvalue, and so on). The resulting plot usually follows the same pattern--first there is a sharp drop-off in successive eigenvalues, then a leveling off. The scree test suggests that analysts retain all factors represented by the eigenvalues

[1]In particular, principal components analysis was used with promax rotation (Stevens 1992). Promax rotation is an oblique rotation method that helps in the interpretation of the factors that result from the principal components analysis.

that occur before the scree plot levels off. For example, if the plot begins to level off between the third and fourth eigenvalues, only the first and second factors would be retained.[2]

The factors, or scales, created as a result of this principal components analysis would be generated by inclusion of those items with sufficiently high factor loadings. If the scree test suggests retaining only a single factor, the resulting scale generally includes all items that were included in the analysis (and for which there is a theoretical justification for inclusion). However, if the scree test suggests retaining more than one factor, only those items with factor loadings in the area of 0.40 or higher are included in a given factor (assuming that these items have loadings well below 0.40 for the other factors). Construction of the actual scales used does not directly use the factor loadings; instead, the scales are simple means or sums of the items that principal components analysis suggests for inclusion in the scale.

Two additional considerations came into play before the use of the scales in the analysis was finalized. First, was the requirement that the items in a given scale have face validity. In other words, the items must be consistent with one another theoretically, and they must represent some well-defined underlying construct. Furthermore, this underlying construct must be distinct from the constructs represented by the items included in other scales.

The second consideration was that the items included in a given scale must be sufficiently reliable. Empirical measures of reliability show the extent to which a given set of items contributing to a scale correlate with one another. Cronbach's alpha was used as the measure of reliability.[3]

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[2]Another commonly used criterion for determining the number of factors to retain is the minimum eigenvalue criterion, in which all factors whose eigenvalue is greater than 1 are retained.

[3]For several of the scales, the contributing items are binary variables. The Kuder-Richardson Formula 20 (KR-20) measure is another indicator of reliability that is specially designed to deal with binary variables. The KR-20 measure was calculated for the scales that include binary items, but it was found that this measure of reliability was almost identical to Cronbach's alpha. Therefore, only (continued...)

Experts usually recommend that items contributing to a scale have a value of Cronbach's alpha of 0.70 or higher (Nunnally 1978). However, this criterion is sometimes relaxed (to levels in the area of 0.60) for items grouped together for some theoretical reason (for example, Haines et al. 1994). This practice was followed in evaluating the reliability of the items included in the scales used in this study.

B. DIETARY KNOWLEDGE AND ATTITUDE FACTORS

As discussed in Chapter II, based on a review of the literature, we broadly classified knowledge and attitudes that influence dietary intake into four areas: (1) nutrition knowledge, (2) dietary beliefs, (3) general dietary attitudes, and (4) attitudes based on social-psychological models. This section discusses the process by which factors were determined in each of these four broad areas. Table A.1 summarizes the factors, the Diet and Health Knowledge Survey (DHKS) item numbers used in the construction of each factor, and the reliability coefficient of the contributing items. Table A.2 lists the DHKS questions used in constructing the factors.

1. Nutrition Knowledge

It was hypothesized that the items in the DHKS support the construction of three measures of nutrition knowledge: (1) diet-disease awareness, (2) knowledge of pyramid servings recommendations, and (3) knowledge of foods' fat and cholesterol content.

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[3](...continued)
Cronbach's alpha is reported in the text.

TABLE A.1

DIETARY KNOWLEDGE AND ATTITUDE SCALE ITEMS AND RELIABILITY

Factor	DHKS Questions	Cronbach's α
Nutrition Knowledge		
Diet-Disease Relation Awareness Factor	6a-6g	0.72
Pyramid Servings Recommendations Knowledge Factor	1a-1e	0.41
Knowledge of Foods' Fat/Cholesterol Content	8a-13	0.60
Dietary Beliefs		
Belief in the Diet-Health Relationship Factor	2f	--[a]
General Dietary Attitudes		
Nutrition Importance Factor	4a-4k	0.82
Social-Psychological-Related Attitudes		
Perceived Micronutrient Susceptibility Factor	3b-3e, 3j[b]	0.55
Perceived Macronutrient Susceptibility Factor	3a, 3f-3i, 3k[b]	0.73

[a]Also examined was DHKS item 2e, to measure individuals' health beliefs. Items 2d and 2f were not strongly correlated with each other and thus could not reliably be combined into a single measure of dietary beliefs.

[b]Items 3a-3k were examined, to measure social-psychological-related attitudes. Principal components analysis on these variables indicated the presence of two distinct factors measuring different aspects of perceived susceptibility.

TABLE A.2

DHKS ITEM DEFINITIONS

Item(s)	Definition	Possible Values
1a - 1e	How many servings from the (FOOD GROUP) would you say a person of your age and sex should eat each day for good health? a. Fruit Group b. Vegetable Group c. Milk, Yogurt, and Cheese Group d. Bread, Cereal, Rice, and Pasta Group e. Meat, Poultry, Fish, Dry Beans, and Eggs Group	Any integer
2e and 2f	e. There are so many recommendations about healthy ways to eat, it's hard to know what to believe. f. What you eat can make a big difference in your chance of getting a disease, like heart disease or cancer.	1 (Strongly disagree) through 4 (Strongly agree)
3a - 3k	Compared to what is healthy, do you think your diet is too low, too high, or about right in (STATEMENT)? a. Calories b. Calcium c. Iron d. Vitamin C e. Protein f. Fat g. Saturated fat h. Cholesterol i. Salt or sodium j. Fiber k. Sugar and sweets	1 (Too low), 2 (Too high), or 3 (About right)
4a - 4k	To you personally, is it very important, somewhat important, not too important, or not at all important to (STATEMENT)? a. Use salt or sodium only in moderation b. Choose a diet low in saturated fat c. Choose a diet with plenty of fruits and vegetables d. Use sugars only in moderation e. Choose a diet with adequate fiber f. Eat a variety of foods g. Maintain a healthy weight h. Choose a diet low in fat i. Choose a diet low in cholesterol j. Choose a diet with plenty of breads, cereals, rice, and pasta k. Eat at least two servings of dairy products daily	1 (Not at all important) through 4 (Very important)
6a - 6g	(Item 5) Have you heard about any health problems caused by (BEHAVIOR)? (Item 6) What problems are these? Any other problems? a. Eating too much fat b. Not eating enough fiber c. Eating too much salt or sodium d. Not eating enough calcium e. Eating too much cholesterol f. Eating too much sugar g. Being overweight	Respondents could name any health problems they wished. Their responses were coded into 17 categories, along with an "other" category.
8a - 8d	Based on your knowledge, which has *more saturated* fat: a. Liver or T-bone steak? b. Butter or margarine? c. Egg white or egg yolk? d. Skim milk or whole milk?	1 (the first choice), 2 (the second choice), or 3 (they have the same amount)

TABLE A.2 *(continued)*

Item(s)	Definition	Possible Values
9a - 9f	Which has *more fat:* a. Regular hamburger or ground round? b. Loin pork chops or pork spare ribs? c. Hot dogs or ham? d. Peanuts or popcorn? e. Yogurt or sour cream? f. Porterhouse steak or round steak?	1 (the first choice), 2 (the second choice), or 3 (they have the same amount)
10	Which kind of fat is more likely to be a liquid rather than a solid: saturated fats, polyunsaturated fats, or are they equally likely to be liquids?	1 (the first choice), 2 (the second choice), or 3 (equally likely)
11	If a food has no cholesterol, is it also: low in saturated fat, high in saturated fat, or could it be either high or low in saturated fat?	1 (the first choice), 2 (the second choice), or 3 (could be either)
12	Is cholesterol found in: vegetables and vegetable oils, animal products like meat and dairy products, or all foods containing fat or oil?	1 (the first choice), 2 (the second choice), or 3 (all foods with fat or oil)
13	If a product is labeled as containing only vegetable oil, is it: low in saturated fat, high in saturated fat, or could it be either high or low in saturated fat?	1 (the first choice), 2 (the second choice), or 3 (could be either)
26a - 26g	Now think about the foods you eat. Would you say you always, sometimes, rarely, or never (HABIT)? a. Eat lower-fat luncheon meats instead of regular luncheon meats b. Use skim or 1% milk instead of 2% or whole milk c. Eat special, low-fat cheeses, when you eat cheese d. Eat ice milk, frozen yogurt, or sherbet instead of ice cream e. Use low-calorie instead of regular salad dressing f. Have fruit for dessert when you eat dessert g. Eat fish or poultry instead of meat	1 (Always or almost always), 2 (Sometimes), 3 (Rarely), or 4 (Never)
27	When you eat baked or boiled potatoes, how often do you add butter, margarine, or sour cream?	1 (Always) through 4 (Never)
28	When you eat other cooked vegetables, do you always, sometimes, rarely, or never eat them with butter or margarine added?	1 (Always) through 4 (Never)
29	When you eat other cooked vegetables, do you always, sometimes, rarely, or never eat them with cheese or another creamy sauce added?	1 (Always) through 4 (Never)
30	When you eat chicken, do you always, sometimes, rarely, or never eat it fried?	1 (Always) through 4 (Never)
31	When you eat chicken, do you always, sometimes, rarely, or never remove the skin?	1 (Always) through 4 (Never)
32	Would you describe the amount of butter or margarine you usually spread on breads and muffins as: none, light, moderate, or generous?	1 (None) through 4 (Generous)
33a - 33b	About how many times a week do you eat (FOOD) — less than once a week, 1-3, 4-6, or 7 or more times? a. Bakery products like cakes, cookies, or donuts b. Chips, such as potato or corn chips	1 (Less than once a week or never) through 4 (7 or More times)
34	And at your *main meal,* about how many times in a week do you eat beef, pork, or lamb? Would you say less than once a week, 1-2, 3-4, or 5-7 times?	1 (Less than once a week or never) through 4 (5-7 times)

TABLE A.2 *(continued)*

Item(s)	Definition	Possible Values
35	When you eat meat, do you usually eat: small, medium, or large portions?	1 (Small) through 3 (Large)
36	When you eat meat and there is visible fat, do you trim the fat always, sometimes, rarely, or never?	1 (Always or almost always) through 4 (Never)
37	How many eggs do you usually eat in a week--less than one, 1-2, 3-4, or 5 or more?	1 (Less than one or none) through 4 (5 or more)

SOURCE: 1994-1996 Diet and Health Knowledge Survey questionnaire.

Diet-Disease Relation Awareness Factor. Individuals' diet-disease awareness is represented by DHKS items 6a through 6g, which ask individuals to identify any health problems they are aware of that are related to seven specific dietary practices. A list of primary health problems associated with each of these dietary practices was developed, followed by the creation of variables indicating whether individuals correctly identified at least one of these health problems. The seven dietary practices and their associated primary health problems are based on information contained in *Dietary Guidelines for Americans* (USDA 1995):

- Eating too much fat--high blood cholesterol, heart disease, being overweight, cancer
- Not eating enough fiber--bowel problems, heart disease, cancer
- Eating too much salt--high blood pressure
- Not eating enough calcium--osteoporosis
- Eating too much cholesterol--high blood cholesterol, heart disease
- Eating too much sugar--teeth problems
- Being overweight--high blood pressure, diabetes, heart disease, stroke, cancer, arthritis, breathing problems

Principal components analysis on these seven items indicated that a single principal component, or factor, should be retained, which includes each of the items. Cronbach's alpha, our measure of reliability for these items, had a value of 0.73.

The Diet-Disease Relation Awareness Factor was constructed by summing the values of the seven binary variables indicating whether individuals are aware of the primary health problems associated with specific dietary practices. This factor takes on values between 0 and 7, with higher values representing a greater awareness of the link between dietary practices and health problems.

Knowledge of Pyramid Servings Recommendations Factor. DHKS items 1a through 1e ask respondents to estimate the number of servings from each USDA food pyramid food group they think "a person of their age and sex should eat each day for good health." On the basis of their responses to these items, a set of five binary variables was created indicating whether individuals' estimates for each of the food groups fall into the recommended range.

Principal components analysis conducted on these five binary variables indicated that they formed a single factor including each item. However, Cronbach's alpha for these items was only 0.41, which is fairly low. Nevertheless, it was decided to create the Pyramid Servings Recommendations Knowledge Factor by summing the five binary variables indicating correct estimates of the recommended number of servings of the five major food groups, based on our belief that theoretical reasons for linking these five variables in a single measure were strong enough to compensate for the low value of Cronbach's alpha.

The Pyramid Servings Recommendations Knowledge Factor measures individuals' instrumental knowledge. This factor takes on values between 0 and 5 and indicates the number of food groups for which an individual knows the number of recommended servings. Higher values of the factor indicate a greater knowledge of USDA dietary recommendations.

Foods' Fat and Cholesterol Awareness Factor. The third set of DHKS items that appear to measure a distinct aspect of nutrition knowledge is the set of 14 items measuring respondents' knowledge of the fat and cholesterol content of foods (DHKS questions 8a through 13). Based on the responses to these questions, a set of 14 binary variables was created indicating whether individuals correctly know 14 pieces of information about foods' fat and cholesterol content.

Principal components analysis yielded mixed results with respect to the number of factors to draw from the items, but a scree test indicated that only a single factor from these items should be retained. Reliability analysis on the 14 binary variables resulted in a Cronbach's alpha value of 0.62. Thus, by averaging the values of the 14 binary variables, the Knowledge of Foods' Fat/Cholesterol Content Factor was created.

The fat/cholesterol knowledge factor also is a measure of individuals' instrumental knowledge. The factor takes on values between 0 and 1 and in some ways can be interpreted as resembling a test score. Higher values of the factor indicate greater knowledge of foods' fat/cholesterol content.

2. Dietary Beliefs

Two DHKS items (2e and 2f) measure individuals' dietary beliefs. Specifically, these items measure the extent to which individuals agree with the following statements: "There are so many recommendations about healthy ways to eat, it's hard to know what to believe" (item 2e); and "What you eat can make a big difference in your chance of getting a disease, like heart disease or cancer" (item 2f). These items are measured on a scale of 1 (strong disagreement) to 4 (strong agreement).

It turns out that these items were not strongly correlated with each other (one would expect a negative correlation). Thus, they could not be reliably combined into a single measure of dietary beliefs. We therefore used item 2f as the measure of the Belief in the Diet-Health Relationship Factor, since this is a more direct measure of individuals' beliefs than is 2e. High values of this factor indicate a strong belief that dietary practices affect health status.

3. General Dietary Attitudes

Dietary attitudes were measured using a set of DHKS items (4a through 4k) that ask individuals how important various positive dietary practices are to them. In particular, individuals rated (on a scale of 1 [not at all important] to 4 [very important]), 11 statements in a set representing the *Dietary Guidelines for Americans*.[4]

The scree test from principal components analysis indicated that a single factor should represent all 11 items. Furthermore, Cronbach's alpha for these 11 items was 0.85, indicating that they are highly reliable. Thus, the Nutrition Importance Factor was created by averaging the values of the 11 contributing items. This factor measures individuals' attitudes toward nutrition in general and follows the dietary guidelines in particular. The factor takes on values from 1 to 4, with higher values indicating more favorable attitudes toward following guidelines for good nutrition.

4. Attitude Constructs Based on Social-Psychological Models

A set of DHKS items was used that measures individuals' self-rated diets to define two other measure of dietary attitudes. In particular, DHKS items 3a through 3k measure the extent to which people think their diets are too high, too low, or about right in 11 different nutrients. Two binary variables were created from each item--one measuring whether individuals think their diets are too low in the nutrient, the second measuring whether they think their diets are too high in the nutrient. Following Haines et al. (1994), and in accordance with the Health-Belief Model, these factors were named "perceived micronutrient susceptibility" and "perceived macronutrient susceptibility."

Principal components analysis on these variables indicated the presence of two distinct factors that measure different aspects of perceived susceptibility. The Perceived Micronutrient Susceptibility Factor included five items that measure the extent to which individuals believe their diets are *too low* in calcium, iron, vitamin C, protein, and fiber; the value of Cronbach's alpha for these five variables was 0.62. The Perceived Macronutrient Susceptibility Factor included six items that measure the

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[4]We also considered including DHKS item 15b, which asks individuals to rate the importance of nutrition to them in buying food. However, because this item added little to the attitude measure eventually developed, it was dropped from the analysis.

extent to which individuals believe their diets are *too high* in calories, fat, saturated fat, cholesterol, salt/sodium, and sugar and sweets; the value of Cronbach's alpha for these six variables was 0.75. Each factor was created by averaging the values of the binary variables that contributed to it. Thus, each takes on values between 0 and 1. Higher values of the factors indicate greater susceptibility--a belief that their diets are too low in "good things" or too high in "bad things."

C. DIETARY BEHAVIOR FACTOR

Nineteen DHKS items were examined that measure dietary habits (items 26a through 37). Similar to the variables used in Kristal's dietary behavior indexes (Kristal et al. 1990), these items include indicators of how often individuals eat meat and fried chicken, add butter or margarine to potatoes or vegetables, or drink skim milk rather than whole milk. All 19 items were rescaled so that each took on values between 1 and 4, with 1 indicating that the person never practices a good dietary habit (or always practices a bad habit) and 4 indicating that the person always practices a good dietary habit (or never practices a bad habit).

We conducted principal components analysis on these 19 items, but the results were inconclusive. When four factors were retained, the composition of the factors closely reflected the composition of four of Kristal's five indexes. However, the scree test suggested retaining only two factors. Further, the values of Cronbach's alpha for two of these four factors were relatively low. On the other hand, the value of Cronbach's alpha for all 19 items, considered together, was 0.77. For this reason, and to simplify the measure of dietary behavior, we created a single Dietary Behavior Factor by averaging the values of the 19 contributing items. This factor takes on values between 1 and 4, with higher values representing more nutritious dietary practices.

APPENDIX B

SUPPLEMENTAL TABLES TO THE ANALYSIS OF DIETARY KNOWLEDGE AND ATTITUDES

TABLE B.1

GENERAL HEALTH/WEIGHT CHARACTERISTICS, BY FSP PARTICIPATION STATUS

Characteristic	FSP Participants	Low-Income Nonparticipants
Self-Reported Weight Status[a]		
Underweight	7	6**
About right	35	56
Overweight	58	38
Body Mass Index[a]		
20 or less	10	10**
20 to 25	21	38
25 to 30	34	31
More than 30	34	21
Self-Reported Health[a]		
Excellent/very good	37	42**
Good	27	35
Fair/poor	35	23
Health Conditions		
Diabetes	17	9*
High blood pressure	27	24
Osteoporosis	5	4
High cholesterol	16	13
Stroke	4	3
Cancer	5	4
Heart disease	13	10
Exercise		
5 or more times a week	29	27
1 to 4 times a week	19	22
1 to 3 times a month	3	4
Rarely or never	49	47
Smoking Status		
Currently a smoker	49	27**
Sample Size	**436**	**1,030**

SOURCE: 1994-1996 Diet and Health Knowledge Survey.

NOTE: Low-income is defined as having household income less than 130 percent of the poverty line.

[a] Test of statistical significance refers to whether there are differences between participants and nonparticipants in the full distribution of the variable. The results of this significance are shown in the first line.

*Significantly different from distribution of variable among participants at the .05 level, two-tailed test.
**Significantly different from distribution of variable among participants at the .01 level, two-tailed test.

TABLE B.2

PERCEIVED SUSCEPTIBILITY FOR FSP PARTICIPANTS AND NONPARTICIPANTS, BY BODY MASS INDEX (BMI)

	FS Participants	Low-Income Nonparticipants
Micronutrient Susceptibility Factor		
BMI less than 20	.36	.28
BMI Between 20 and 25	.37	.28
BMI Greater than 25	.36	.25
All	.34	.27
Macronutrient Susceptibility Factor		
BMI less than 20	.26	.22
BMI Between 20 and 25	.34	.26
BMI Greater than 25	.40	.34
All	.37	.29
Sample Size	**436**	**1,030**

SOURCE: 1994-1996 Diet and Health Knowledge Survey.

NOTE: Low-income is defined as a household with income less than 130 percent of the poverty line.

APPENDIX C

SUPPLEMENTAL TABLES RELATED TO THE ANALYSIS OF DIETARY INTAKE

TABLE C.1

MEASURES OF DIETARY BEHAVIOR, BY FSP PARTICIPATION STATUS
(Low-Income Adults)

	FSP Participants	Nonparticipants[a]
Modifying Meat (Percentage Who):		
When Eating Chicken, Never Eat It Fried	8	13
When Eating Chicken, Always Remove the Skin	34	44**
When Eating Red Meat, Usually Eat Small Portions	29	34*
When Eating Red Mean, Always Trim the Fat	65	67
Avoiding Fat as Seasoning (Percentage Who):		
Never Put Butter or Margarine on Cooked Vegetables	22	26**
Always Eat Boiled or Baked Potatoes Without Butter or Margarine	10	15*
Never Put Cheese or Another Creamy Sauce on Cooked Vegetables	35	40*
Usually Spread No Butter or Margarine on Breads and Muffins	11	15**
Substitution (Percentage Who):		
Always Eat Fish or Poultry Instead of Red Meat	19	18
Always Use Skim or 1% Milk Instead of 2% or Whole Milk	18	26**
Always Eat Special, Low-Fat Cheeses When Eating Cheese	6	13**
Always Eat Ice Milk, Frozen Yogurt, or Sherbet Instead of Ice Cream	12	16*
Always Use Low-Calorie Instead of Regular Salad Dressing	18	25**
Always Eat Low-Fat Luncheon Meats Instead of Regular Luncheon Meat	13	19**
Replacement (Percentage Who):		
Eat Meat at Main Meal Less than Once a Week	12	13
Always Have Fruit for Dessert When Eating Dessert	14	21**
Eat Chips, Such as Corn or Potato Chips, Less than Once a Week	45	54**
Eat Bakery Products (Cakes, Cookies, Donuts) Less than Once a Week	43	35
Eat Less than One Egg a Week	23	26
Dietary Behavior Factor (α=0.77)[b]	2.48	2.65
Sample Size	**436**	**1,030**

SOURCE: Weighted tabulations based on the 1994-1996 Diet and Health Knowledge Survey.

NOTE: Tests of statistical significance were conducted after taking into account design effects due to complex sampling and sample weights.

[a] The significance tests refer to the difference in the outcome among FSP participants and low-income nonparticipants.

[b] The Dietary Behavior Factor is the average score of the 19 items listed in the table. This factor is measured on a 1 to 4 scale, with higher values representing more nutritious dietary behavior. The value of Cronbach's alpha is shown in parentheses.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

TABLE C.2

FOOD GROUP INTAKE, BY FSP PARTICIPATION STATUS
(Low-Income Individuals)

	Preschoolers		School-Age Children		Adults	
Number of Servings	FSP Participants	Non-Participants	FSP Participants	Non-Participants	FSP Participants	Non-Participants
Grain Products (Percentages)						
0 to 5	44	52	36	41	55	50
6 to 11	56	43	58	51	37	42
More than 11	<1	5	5	8	8	8
(Mean)	6.0	6.0	6.7	6.9	6.1	6.3
Vegetables (Percentages)						
0 to 2	58	63	52	49	52	44
3 to 5	39	34	38	43	36	42
More than 5	3	3	10	8	12	14
(Mean)	2.4	2.3	2.7	2.8	2.9	3.3
Fruit (Percentages)						
0 to 1	52	42	64	68	74	70
2 to 4	40	48	31	29	21	25
More than 4	7	10	5	3	5	5
(Mean)	1.8	2.1	1.5	1.2	1.1	1.3
Dairy Products (Percentages)						
0 to 1	44	44	39	42	75	70
2 to 3	51	49	52	50	18	26
More than 3	5	7	9	9	7	4
(Mean)	1.8	1.9	1.9	1.8	1.2	1.2
Meat and Meat Substitutes (Percentages)						
0 to 1	73	71	47	48	39	42
2 to 3	27	28	46	46	49	47
More than 3	1	1	7	6	11	10
(Mean)	1.2	1.2	1.8	1.7	2.1	1.9
Servings of Red Meat (Mean)	0.7	0.7	1.1	1.0	1.2	1.1
Servings of Poultry (Mean)	0.3	0.3	0.4	0.4	0.5	0.5
Servings of Fish (Mean)	<0.1	0.1	0.1	0.1	0.1	0.2
Number of Eggs (Mean)	0.1	0.1	0.2	0.1	0.2	0.2
Servings of Nuts and Seeds (Mean)	0.1	0.1	<0.1	0.1	0.1	<0.1
Grams of Discretionary Fat (Mean)	43.5	42.3	58.2	57.3	54.5	52.4
Teaspoons of Added Sugar (Mean)	12.9	12.7	21.2	23.6	20.3	17.5
Number of Alcoholic Drinks (Mean)	0.0	0.0	<0.1	0.1	0.2	0.5
Sample Size	**311**	**260**	**442**	**484**	**602**	**1,622**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

TABLE C.3

NUTRIENT INTAKE AMOUNTS, BY FSP PARTICIPATION STATUS
(Low-Income Individuals)

	Preschoolers		School-Age Children		Adults	
	FSP Participants	Non-Participants	FSP Participants	Non-Participants	FSP Participants	Non-Participants
Macronutrients						
Food Energy (kcal)	1,439	1,408	1,988	1,990	1,905	1,871
Protein (g)	54	54	74	72	75	73
Vitamins						
Vitamin A (mcg RE)	722	720	820	845	762	889
Vitamin C (mg)	93	96	101	93	83	91
Vitamin E (mg)	4.9	4.9	6.8	6.7	6.7	7.4**
Vitamin B_6 (mg)	1.3	1.4	1.7	1.6*	1.6	1.6
Vitamin B_{12} (mcg)	4.0	3.5	4.6	5.2	5.6	4.9
Niacin (mg)	15	14	20	20	21	21
Thiamin (mg)	1.2	1.2	1.6	1.5*	1.4	1.5
Riboflavin (mg)	1.7	1.7	2.0	1.9	1.7	1.7
Folate (mcg)	196	203	248	228*	212	239**
Minerals						
Calcium (mg)	770	818	873	835	672	693
Iron (mg)	12	11	15	14*	14	14
Magnesium (mg)	183	191	231	226	232	251*
Phosphorus (mg)	967	982	1,222	1,203	1,116	1,145
Zinc (mg)	8.3	7.9	11.1	10.5	10.9	10.5
Sample Size	**419**	**366**	**442**	**484**	**602**	**1,622**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: The tests of statistical significance refer to differences in outcomes among FSP participants and low-income nonparticipants. The tests were conducted after taking into account design effects due to complex sampling and sample weights.

kcal = kilo calories
g = grams
mg = milligrams
mcg = micrograms
RE = retinol equivalent

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

TABLE C.4

NUTRIENT INTAKE AS A PERCENTAGE OF THE RDA, BY PARTICIPATION STATUS
(Low-Income Individuals)

	Preschoolers		School-Age Children		Adults	
	FSP Participants	Non-Participants	FSP Participants	Non-Participants	FSP Participants	Non-Participants
Macronutrients						
Food Energy	100	101	91	89	81	78
Protein	299	308	212	195**	139	133
Vitamins						
Vitamin A	167	171	114	113	100	101
Vitamin C	224	234	204	187	137	151
Vitamin E	78	79	85	81	77	82
Vitamin B_6	129	135	119	107**	88	92
Vitamin B_{12}	498	461	303	338	278	244
Niacin	150	146	140	131*	130	129
Thiamin	161	162	150	137**	119	120
Riboflavin	195	202	157	146	120	120
Folate	348	373	214	188**	112	124**
Minerals						
Calcium	96	102**	91	84	80	78
Iron	117	114	132	119**	115	126
Magnesium	204	221**	115	106**	76	80
Phosphorus	121	127	126	120	132	130
Zinc	83	79	95	88**	82	78
Sample Size	**419**	**366**	**442**	**484**	**602**	**1,622**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: The tests of statistical significance refer to differences in outcomes among FSP participants and low-income nonparticipants. The tests were conducted after taking into account design effects due to complex sampling and sample weights.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

TABLE C.5

PERCENTAGE OF INDIVIDUALS WHOSE USUAL NUTRIENT INTAKE MEETS RECOMMENDED THRESHOLDS, BY FSP PARTICIPATION STATUS
(Low-Income Individuals)

	Preschoolers		School-Age Children		Adults	
	FSP Participants	Non-Participants	FSP Participants	Non-Participants	FSP Participants	Non-Participants
Macronutrients						
Food Energy						
70 percent of RDA	91	90	89	88	64	63
100 percent of RDA	50	47	37	32	23	19
Protein						
70 percent of RDA	100	100	100	100	95	96
100 percent of RDA	100	100	98	97	78	79
Vitamins						
Vitamin A						
70 percent of RDA	99	98	86	72*	58	65
100 percent of RDA	88	88	60	45	36	39
Vitamin C						
70 percent of RDA	99	99	98	96	86	84
100 percent of RDA	95	95	93	87	69	69
Vitamin E						
70 percent of RDA	60	58	83	76	58	59
100 percent of RDA	19	20	25	22	23	26
Vitamin B_6						
70 percent of RDA	97	93*	93	93	70	75
100 percent of RDA	79	73	70	59*	33	39
Vitamin B_{12}						
70 percent of RDA	100	100	100	100	95	98
100 percent of RDA	100	100	99	99	85	90
Niacin						
70 percent of RDA	98	95	98	99	95	96
100 percent of RDA	88	80*	87	85	74	78
Thiamin						
70 percent of RDA	100	99	99	99	91	94
100 percent of RDA	96	92	91	91	66	71
Riboflavin						
70 percent of RDA	100	100	99	99	88	92
100 percent of RDA	98	98	91	90	61	68
Folate						
70 percent of RDA	100	100	99	98	84	88
100 percent of RDA	100	100	94	91	55	66**

TABLE C.5 *(continued)*

	Preschoolers		School-Age Children		Adults	
	FSP Participants	Non-Participants	FSP Participants	Non-Participants	FSP Participants	Non-Participants
Minerals						
Calcium						
70 percent of RDA	81	82	74	68	51	56
100 percent of RDA	47	50	40	29	24	25
Iron						
70 percent of RDA	93	83**	96	93	77	85
100 percent of RDA	67	52**	78	68*	52	62
Magnesium						
70 percent of RDA	100	100	89	81*	56	63*
100 percent of RDA	98	98	63	52*	18	24
Phosphorus						
70 percent of RDA	96	96	74	68	90	93
100 percent of RDA	76	75	40	29	69	74
Zinc						
70 percent of RDA	73	59**	85	78	57	56
100 percent of RDA	26	18	40	31	22	19
Sample Size	**419**	**366**	**442**	**484**	**602**	**1,622**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: Usual intake calculations were made using two days of individuals intake information after correcting for intra-individual variation using the SIDE statistical software. Tests of statistical significance refer to the difference in the outcome among FSP participants and nonparticipants. These tests were conducted after taking into account design effects due to complex sample and sample weights.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

TABLE C.6

PERCENTAGE OF INDIVIDUALS WHOSE TWO-DAY MEAN NUTRIENT INTAKE MEETS RECOMMENDED THRESHOLDS, BY FSP PARTICIPATION STATUS
(Low-Income Individuals)

	Preschoolers			School-Age Children			Adults		
	All	FSP Participants	Non-Participants	All	FSP Participants	Non-Participants	All	FSP Participants	Non-Participants
Macronutrients									
Food Energy									
70 percent of RDA	81	83	78	75	76	75	56	56	56
100 percent of RDA	45	46	43	33	37	30*	21	24	20
Protein									
70 percent of RDA	100	100	100	98	98	97	88	87	88
100 percent of RDA	99	99	99	92	92	91	69	68	69
Vitamins									
Vitamin A									
70 percent of RDA	88	87	89	60	65	56*	48	44	50**
100 percent of RDA	71	68	75*	38	41	34	32	28	34**
Vitamin C									
70 percent of RDA	88	88	89	81	84	78	67	62	70**
100 percent of RDA	80	79	81	71	73	70	53	47	56**
Vitamin E									
70 percent of RDA	51	52	49	56	59	54	49	46	50
100 percent of RDA	22	21	24	27	28	26	25	22	26*
Vitamin B_6									
70 percent of RDA	88	88	87	80	80	80	62	59	63
100 percent of RDA	67	68	66	54	59	49**	36	33	37
Vitamin B_{12}									
70 percent of RDA	100	100	100	97	96	97	85	83	86
100 percent of RDA	99	98	100	91	92	90	74	71	76
Niacin									
70 percent of RDA	90	91	88	91	91	91	86	85	86
100 percent of RDA	76	79	73	72	75	70	65	63	66
Thiamin									
70 percent of RDA	95	95	95	93	92	94	83	81	84
100 percent of RDA	85	85	85	77	80	74	58	55	59
Riboflavin									
70 percent of RDA	99	98	99	93	93	93	81	78	82
100 percent of RDA	92	91	93	79	81	78	56	53	58*
Folate									
70 percent of RDA	100	100	100	90	92	89	72	67	75**
100 percent of RDA	98	98	98	80	83	77*	51	46	54**
Minerals									
Calcium									
70 percent of RDA	69	70	68	62	63	60	47	43	49*
100 percent of RDA	45	42	48	33	36	30	24	24	24
Iron									
70 percent of RDA	80	82	78	85	86	83	72	65	75**
100 percent of RDA	54	56	51	60	64	56*	51	45	54**

TABLE C.6 *(continued)*

	Preschoolers			School-Age Children			Adults		
	All	FSP Participants	Non-Participants	All	FSP Participants	Non-Participants	All	FSP Participants	Non-Participants
Magnesium									
70 percent of RDA	99	98	100	72	75	70	55	50	57**
100 percent of RDA	94	93	96	50	53	47	23	21	23
Phosphorus									
70 percent of RDA	90	90	91	88	88	88	85	82	86*
100 percent of RDA	66	67	65	66	66	65	65	61	66
Zinc									
70 percent of RDA	54	56	50	67	71	64	50	49	50
100 percent of RDA	24	27	21**	35	40	30	23	26	22
Sample Size	**785**	**419**	**366**	**926**	**442**	**484**	**2,224**	**602**	**1,622**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: Nutrient intake calculations were made using two days of individuals intake information. No corrections were made for intra-individual variation in nutrient intake. Tests of statistical significance refer to the difference in the outcome among FSP participants and nonparticipants. These tests were conducted after taking into account design effects due to complex sample and sample weights.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

TABLE C.7

INTAKE OF MACRONUTRIENTS AND OTHER DIETARY COMPONENTS, BY FSP PARTICIPATION STATUS
(Low-Income Individuals)

	Preschoolers		School-Age Children		Adults	
	FSP Participants	Non-Participants	FSP Participants	Non-Participants	FSP Participants	Non-Participants
Macronutrients						
Food Energy (kcal)	1439	1408	1988	1990	1905	1871
Percentage of Food Energy from:						
Fat	34	34	34	33	34	33
Saturated fat	14	13	12	12*	11	11
Protein	15	15	15	15**	16	16
Carbohydrate	52	52	52	53	50	50
Other Dietary Components						
Dietary Fiber (g)	8.9	9.7*	12.9	13.0	12.8	14.7*
Cholesterol (mg)	215	211	279	257	297	278
Sodium (mg)	2313	2234	3248	3153	3279	3165
Percentage Meeting Dietary Guidelines						
No more than 30 percent of food energy from fat	19	30**	25	29	32	33
Less than 10 percent of food energy from saturated fat	12	17	20	24	36	38
More than 55 percent of food energy from carbohydrate	31	38	32	39*	31	32
No more than twice the RDA of protein	20	19	51	59*	85	89
More than 20 g of dietary fiber	3	7	14	11	15	21*
No more than 300 mg of cholesterol	81	77	67	67	60	64
No more than 2,400 mg of sodium	54	58	27	31	38	36
Sample Size	**571**		**926**		**2,224**	

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: The sample of preschoolers includes only those age 2 to 4. Tests of statistical significance refer to the difference in the outcome among FSP participants and nonparticipants. These tests were conducted after taking into account design effects due to complex sample and sample weights.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

g = grams; mg = milligrams

TABLE C.8

DISTRIBUTION OF NUTRIENT INTAKE: BY WHERE FOOD WERE OBTAINED
(Low-Income Individuals)

	Preschoolers		School-Age Children		Adults	
Percentage of Food Energy from Food Source	FSP Participants	Non-Participants	FSP Participants	Non-Participants	FSP Participants	Non-Participants
Store-bought foods	81	84	69	66	79	73**
Restaurant-bought foods	11	10	10	15**	14	19**
Other foods	8	6**	22	19	7	8
Sample Size	**419**	**366**	**442**	**484**	**602**	**1,622**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

TABLE C.9

SUMMARY MEASURES OF DIET QUALITY, BY FSP PARTICIPATION STATUS
(Low-Income Individuals)

	Preschoolers		School-Age Children		Adults	
	FSP Participants	Non-Participants	FSP Participants	Non-Participants	FSP Participants	Non-Participants
Healthy Eating Index	68	70	62	63	58	60
Diet Quality Index	7.8	7.5	8.0	7.8	7.8	7.4
Sample Size	**311**	**260**	**442**	**484**	**602**	**1,622**

SOURCE: Weighted tabulations based on the 1994-1996 CSFII.

NOTE: Sample of preschoolers includes only those age 2 through 4.

[a] The Healthy Eating Index (HEI) was created by Kennedy et al. (1995). Higher values of the HEI indicate healthier diets.

[b] The Diet Quality Index was created by Patterson et al. (1994). Lower values of the DQI indicate healthier diets.

APPENDIX D

FULL REGRESSION RESULTS FOR SELECTED MODELS

TABLE D.1

FULL REGRESSION COEFFICIENTS IN SELECTED SPECIFICATIONS OF BASIC MODEL
(Preschoolers)
(Standard Errors in Parentheses)

	Dependent Variable					
Independent Variables	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
Intercept	2.277**	105.123**	150.616**	-.278	78.393**	88.038**
	(0.484)	(9.430)	(13.365)	(.707)	(3.684)	(5.231)
Program Benefits						
Per capita food stamp benefits	.003	-.000	-.060	-.005	-.018	.0006
	(.002)	(.046)	(.065)	(.004)	(.018)	(.025)
Per capita AFDC benefits	-.001	-.006	.014	.001	-.005	.0178
	(.001)	(.027)	(.039)	(.002)	(.010)	(.0152)
Per capita value of WIC benefits	.001	.152	.060	-.006	.082	-.030
	(.007)	(.129)	(.183)	(.010)	(.051)	(.072)
Per capita household value of NSLP benefits	-.008	.238	.722*	.012	.129	-.109
	(.013)	(.270)	(.383)	(.020)	(.100)	(.150)
Per capita household value of SBP benefits	-.002	-.074	-.849	-.013	-.135	.394
	(.030)	(.617)	(.875)	(.046)	(.226)	(.342)
Participation in child care feeding program	-.274*	7.306**	12.394**	.089	3.59**	-14.467**
	(.150)	(3.172)	(4.496)	(.241)	(1.140)	(1.769)
Income and Assets						
Per capita (monthly) household income ($100)	-.038	-.4.826	-3.598	-.432	-2.865*	1.323
	(.194)	(3.919)	(5.555)	(.291)	(1.479)	(2.176)
Per capita (monthly) household income squared ($100)	.00013	.00973	.00551	.00091	.00727**	.006492
	(.00038)	(.00775)	(.01098)	(.00056)	(.00286)	(.00430)
Whether household holds at least $500 in cash assets	.042	3.721	7.200	-.310	-.991	-3.241
	(.236)	(4.178)	(5.921)	(.317)	(1.799)	(2.323)
Whether someone in household owns the house	.387**	-1.393	-2.408	-.487**	-1.817	2.699*
	(.152)	(2.954)	(4.187)	(.228)	(1.157)	(1.636)
Demographic Characteristics (binary variables)						
Age=2	--	2.940	-28.727**	.633**	--	-3.897*
		(3.199)	(4.534)	(.242)		(1.781)
Age=3	.092	9.067**	-26.128**	.232	0.074	-6.863**
	(.148)	(3.711)	(5.260)	(.286)	(1.124)	(2.066)
Age=4	.175	-19.102**	-20.336**	-.071	-8.202**	-7.085**
	(.147)	(3.755)	(5.321)	(.300)	(1.116)	(2.101)
Female	.106	-6.076**	-4.889	.014	-0.409	2.251*
	(.120)	(2.360)	(3.344)	(.179)	(.910)	(1.309)
Hispanic	.203	-5.889*	-3.088	.345	1.281	-.230
	(.182)	(3.531)	(5.004)	(.261)	(1.386)	(1.955)
Non-Hispanic black	-.083	-1.712	-11.405**	-.156	-2.084	1.158
	(.169)	(3.370)	(4.777)	(.264)	(1.286)	(1.873)
Other racial/ethnic group	.100	-11.585**	-2.044	.454	-2.912	1.755
	(.267)	(5.126)	(7.265)	(.374)	(2.028)	(2.834)
Midwest	-.101	7.051*	-1.030	-.335	-2.472	-6.012**
	(.210)	(4.135)	(5.861)	(.303)	(1.595)	(2.296)
South	-.295	-.642	-10.328*	-.470	-3.443**	-4.727**
	(.203)	(3.952)	(5.601)	(.288)	(1.541)	(2.191)

TABLE D.1 *(continued)*

Independent Variables	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
	Dependent Variable					
West	-.461**	-3.535	-7.177	-.545*	-3.728**	-3.014
	(.202)	(4.011)	(5.684)	(.290)	(1.536)	(2.227)
Urban	-.032	.187	-6.751	-.034	0.477	.539
	(.149)	(2.930)	(4.152)	(.218)	(1.136)	(1.622)
Rural	.145	-.434	-10.531**	-.308	-1.790	-3.822**
	(.174)	(3.376)	(4.784)	(.260)	(1.327)	(1.872)
Household Characteristics (Binary Variables)						
Single adult with child(ren)	.097	-2.523	-12.531**	-.407	-0.838	-5.278**
	(.184)	(3.610)	(5.116)	(.276)	(1.401)	(1.999)
Multiple (nonmarried) adults with child(ren)	.122	-.521	-0.808	.196	-.700	.386
	(.172)	(3.341)	(4.735)	(.246)	(1.308)	(1.855)
Number in hHousehold	-.018	-.074	-3.350**	-.025	-.569	.432
	(.051)	(1.006)	(1.425)	(.076)	(.391)	(.558)
Household head is a high school dropout	.321**	2.008	7.702*	-.257	0.305	4.959**
	(.152)	(3.023)	(4.284)	(.237)	(1.159)	(1.674)
Household head attended but did not complete college	.346**	2.420	10.111**	.421*	3.343**	.640
	(.162)	(3.177)	(4.503)	(.231)	(1.236)	(1.761)
Household head is a college graduate	-.145	-6.695	4.193	-.130	3.333	3.075
	(.283)	(5.250)	(7.441)	(.409)	(2.153)	(2.926)
Health-Related Variables (binary variables)						
Self-reported health = excellent	-.324**	1.590	-1.480	.346	1.449	1.948
	(.160)	(3.264)	(4.626)	(.250)	(1.216)	(1.815)
Self-reported health = very good	-.346*	4.071	1.062	.025	1.349	1.512
	(.183)	(3.702)	(5.247)	(.291)	(1.392)	(2.065)
Self-reported health = fair or poor	-.424	-5.587	-2.567	.461	0.712	-.555
	(.310)	(6.299)	(8.927)	(.446)	(2.358)	(3.478)
Individual takes vitamin supplements	.153	5.698**	-1.364	.206	0.631	.148
	(.124)	(2.474)	(3.507)	(.186)	(0.945)	(1.377)
Other Variables						
Number of hours per day watched TV	-.015	1.569**	.918	-.030	-0.146	.874*
	(.124)	(.587)	(.832)	(.045)	(0.214)	(.325)
Whether household usually shops for food once a month or less	.149	2.065	-3.448	-.299	-1.489	-2.232
	(.153)	(2.979)	(4.222)	(.236)	(1.166)	(1.656)
Whether intake interviews took place in the winter	-.062	-5.278	-1.336	-.044	0.599	-.404
	(.181)	(3.541)	(5.018)	(.264)	(1.376)	(1.962)
Whether intake interviews took place in the spring	.167	-12.016**	-7.113	.091	-2.371*	-.887
	(.163)	(3.196)	(4.530)	(.238)	(1.238)	(1.780)
Whether intake interviews took place in the fall	-.157	-6.467**	2.744	-.243	-2.500	-.657
	(.164)	(3.240)	(4.592)	(.251)	(1.249)	(1.798)
Whether intake interviews took place on the 1st through 10th of the month (on average)	-.194	.233	-1.783	.026	-0.246	-.559
	(.153)	(2.989)	(4.236)	(.224)	(1.166)	(1.659)
Whether intake interviews took place on the 21st through 31st of the month (on average)	.067	-2.135	-1.961	-.140	0.083	-.618
	(.149)	(2.877)	(4.078)	(.220)	(1.132)	(1.597)

TABLE D.1 *(continued)*

	Dependent Variable					
Independent Variables	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
Survey year = 1995	-.142	2.433	3.049	.068	1.910*	1.332
	(.144)	(2.811)	(3.983)	(.215)	(1.097)	(1.568)
Survey year = 1996	.062	2.742	5.057	.294	0.656	1.813
	(.148)	(2.957)	(4.191)	(.223)	(1.125)	(1.638)
Sample Size	**571**	**785**	**785**	**785**	**571**	**775**
Mean of Dependent Variable	2.33	100.83	99.00	0.24	69.24	83.24
R-Squared	0.098	0.168	0.136	--	0.214	.235

SOURCE: 1994-1996 CSFII.

NOTE: All models estimated using OLS regression except for "Whether Fat Intake <= 30% of Food Energy Model," which was estimated using a logit model. All models also included dummy variables controlling for whether information on asset balances was missing and whether information on participation in a child care feeding program was missing.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

TABLE D.2

FULL REGRESSION COEFFICIENTS IN SELECTED SPECIFICATIONS OF BASIC MODEL
(School-Age Children)
(Standard Errors in Parentheses)

Independent Variables	Dependent Variable					
	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
Intercept	2.300**	82.817	53.611**	-1.823	58.841**	61.859**
	(.564)	(9.149)	(12.264)	(.003)	(2.813)	(6.796)
Program Benefits						
Per capita food stamp benefits	-.001	-.018	.034	.004	-.004	.0825**
	(.002)	(.040)	(.053)	(.003)	(.012)	(.0294)
Per capita AFDC benefits	.001	.044	.036	-.001	.001	.013
	(.001)	(.024)	(.031)	(.002)	(.007)	(.017)
Per capita value of WIC benefits	.019	.230	.139	-.053**	-.051	.045
	(.012)	(.200)	(.266)	(.019)	(.061)	(.147)
Per capita household value of NSLP benefits	-.012	.144	.577**	-.007	.001	-.101
	(.009)	(. 140)	(.186)	(.011)	(.043)	(.103)
Per capita household value of SBP benefits	.026*	-.170	-.405	-.072**	-.011	-.971**
	(.016)	(.259)	(.344)	(.023)	(.079)	(.190)
Income and Assets						
Per capita (monthly) household income ($100)	.343	4.339	11.506**	-.040	.475	.069**
	(.239)	(3.915)	(5.191)	(.003)	(1.191)	(.029)
Per capita (monthly) household income squared ($100)	-.00064	-.00532	-.02350**	.00028	.00188	.01330**
	(.00048)	(.00792)	(.01051)	(.00067)	(.00241)	(.00579)
Whether household holds at least $500 in cash assets	.359*	-1.272	1.524	.008	-.007	-2.442
	(.206)	(3.370)	(4.469)	(.268)	(1.025)	(2.463)
Whether someone in household owns the house	-.197	-4.336*	-2.197	-.024	-.225	1.036
	(.145)	(2.369)	(3.141)	(.194)	(.720)	(1.737)
Demographic Characteristics (binary variables)						
Age=5 to 6	-.872**	3.234	21.307**	-.112	6.857**	2.028
	(.215)	(3.522)	(4.671)	(.280)	(1.071)	(2.607)
Age=7 to 10	-.955**	1.325	24.977**	-.408	3.965**	-3.133
	(.208)	(3.406)	(4.516)	(.276)	(1.036)	(2.519)
Age=11 to 14 and female	-.548**	-6.051	-17.134**	-.298	-.025	.447
	(.239)	(3.917)	(5.193)	(.318)	(1.191)	(2.891)
Age=15 to 18 and female	-.312	-3.481	-19.285**	.170	-1.641	-3.437
	(.277)	(4.536)	(6.014)	(.353)	(1.379)	(3.358)
Age=15 to 18 and male	1.011**	1.647	5.365	-.111	-2.266*	-6.708**
	(.262)	(4.290)	(5.689)	(.348)	(1.305)	(3.192)
Hispanic	.115	-4.678	-3.710	.708**	1.836**	-1.358
	(.179)	(2.936)	(3.894)	(.239)	(0.893)	(2.173)
Non-Hispanic black	.045	.344	-16.583**	-.219	-1.121	.384
	(.187)	(3.060)	(4.057)	(.266)	(.931)	(2.245)
Other racial/ethnic group	.775**	-17.757**	-23.691**	1.553**	1.182	2.915
	(.325)	(5.319)	(7.053)	(.406)	(1.618)	(3.890)
Midwest	.626**	11.237**	18.603**	-.045	-.789	-10.339**
	(.226)	(3.709)	(4.918)	(.298)	(1.128)	(2.749)
South	.328	1.128	6.410	.052	-1.819*	-5.281**
	(.212)	(3.469)	(4.600)	(.284)	(1.055)	(2.540)

TABLE D.2 *(continued)*

Independent Variables	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
	Dependent Variable					
West	.276	1.844	10.621**	-.142	-.994	-2.781
	(.207)	(3.387)	(4.492)	(.271)	(1.030)	(2.476)
Urban	-.243	-1.404	5.541	-.265	-.043	.437
	(.171)	(2.709)	(3.592)	(.219)	(.824)	(1.992)
Rural	-.243	-1.978	.652	-.367	-1.384	-2.525
	(.171)	(2.807)	(3.723)	(.232)	(.854)	(2.065)
Household Characteristics (binary variables)						
Single adult with child(ren)	.236	1.590	2.986	.240	1.563*	-3.480
	(.182)	(2.989)	(3.964)	(.251)	(.909)	(2.189)
Multiple (nonmarried) adults with child(ren)	.023	.163	3.191	-.591**	-1.713*	-1.446
	(.177)	(2.895)	(3.838)	(.247)	(.880)	(2.138)
Number in household	-.016	-.855	-1.783	.201**	.320	1.522**
	(.049)	(.805)	(1.068)	(.069)	(.245)	(.589)
Household head is a high school dropout	.080	.792	.311	-.444**	-.735	.079
	(.154)	(2.525)	(3.348)	(.221)	(.768)	(1.857)
Household head attended but did not complete college	-.018	-.358	2.830	. 485**	1.072	-4.985**
	(.172)	(2.814)	(3.731)	(.219)	(.856)	(2.067)
Household head is a college graduate	-.110	-4.931	1.432	.158	2.146	.985
	(.270)	(4.419)	(5.860)	(.345)	(1.344)	(3.261)
Health-Related Variables (binary variables)						
Self-reported health = excellent	.349**	3.045	5.306	.038	-1.072	.865
	(.163)	(2.674)	(3.545)	(.223	(.813)	(1.955)
Self-reported health = very good	.276	1.761	1.139	.046	-.023	1.139
	(.171)	(2.808)	(3.723)	(.231)	(.854)	(2.056)
Self-reported health = fair or poor	-.061	-1.722	-9.621	.307	.605	-1.166
	(.277)	(4.540)	(6.020)	(.368)	(1.381)	(3.368)
Individual takes vitamin supplements	-.178	2.730	7.886**	.257	1.648**	1.696
	(.139)	(2.284)	(3.028)	(.186)	(.695)	(1.679)
Other Variables						
Number of hours per day watched TV	.031	-.183	-1.727**	.031	-.215	2.552**
	(.027)	(.450)	(.597)	(.037)	(.137)	(.329)
Whether household usually shops for food once a month or less	.184	1.821	.929	.097	-1.128	-2.786
	(.156)	(2.562)	(3.397)	(.214)	(.779)	(1.877)
Whether intake interviews took place in the winter	.018	2.913	9.554**	-.282	2.588**	-7.630**
	(.185)	(3.037	(4.027)	(.240)	(.924)	(2.228)
Whether intake interviews took place in the spring	-.284	-2.024	7.614**	-.744**	-1.207	-4.315**
	(.178)	(2.912)	(3.861)	(.246)	(.886)	(2.141)
Whether intake interviews took place in the fall	-.151	1.240	9.998**	-.655**	-.060	-5.178**
	(.164)	(2.690)	(3.567)	(.221)	(.818)	(1.968
Whether intake interviews took place on the 1st through 10th of the month (on average)	-.267	-5.337**	1.976	.053	-.727	-1.977
	(.165)	(2.706)	(3.588)	(.227)	(.823)	(1.986)
Whether intake interviews took place on the 21st through 31st of the month (on average)	-.250*	-.774	-3.531	.241	-.141	-4.873**
	(.150)	(2.458)	(3.259)	(.198)	(.747)	(1.808)

TABLE D.2 *(continued)*

	Dependent Variable					
Independent Variables	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
Survey year = 1995	.067	-.171	6.035*	.527**	2.849**	.805
	(.158)	(2.583)	(3.426)	(.216)	(.756)	(1.905)
Survey year = 1996	.295**	4.448*	3.087	.376*	2.581**	-1.990
	(.151)	(2.469)	(3.274)	(.209)	(.751)	(1.809)
Sample Size	**926**	**926**	**926**	**926**	**926**	**912**
Mean of Dependent Variable	2.62	89.94	88.52	0.25	62.71	68.07
R-Squared	0.147	0.093	0.277	--	0.227	.197

SOURCE: 1994-1996 CSFII.

NOTE: All models estimated using OLS regression except for "Whether Fat Intake <= 30% of Food Energy Model," which was estimated using a logit model. All models also included dummy variables controlling for whether information on asset balances was missing and whether information on participation in a child care feeding program was missing.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

TABLE D.3

FULL REGRESSION COEFFICIENTS IN SELECTED SPECIFICATIONS OF BASIC MODEL
(Adults)
(Standard Errors in Parentheses)

	Dependent Variable						
Independent Variables	Dietary Behavior Index	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
Intercept	1.825**	2.927**	68.921**	78.735**	-.622	49.9	65.134**
	(.114)	(.539)	(7.674)	(11.739)	(.557)	(2.55)	(5.712)
Program Benefits							
Per capita food stamp benefits	-.0002	-.003*	.001	.001	-.001	-.010	.043**
	(.0004)	(.002)	(.028)	(.043)	(.002)	(.009)	(.021)
Per capita AFDC benefits	-.0001	.001	.009	-.012	.0002	-.002	.023
	(.0003)	(.001)	(.019)	(.030)	(.001)	(.006)	(.014)
Per capita value of WIC benefits	-.003	-.001	.053	-.130	.002	.084	.028
	(.002)	(.010)	(.139	(.213)	(.010)	(.046)	(.103)
Per capita household value of NSLP benefits	-.003	-.005	.100	.001	-.007	.018	.112
	(.003)	(.012)	(.164)	(.251)	(.012)	(.055)	(.121)
Per capita household value of SBP benefits	-.004	-.000	.639*	.460	-.020	-.091	-.303
	(.005)	(.024)	(.337)	(. 515)	(.025)	(.112)	(.250)
Income and Assets							
Per capita (monthly) household income ($100)	-.038**	.131	3.062**	3.153**	-.002**	.075	-.008
	(.001)	(.069)	(.979)	(.015)	(.001)	(.326)	(.007)
Per capita (monthly) household income squared ($100)	.00003**	-.00012	.00243**	-.00234	.00003**	.00017	.00044
	(.00002)	(.00008)	(.00109)	.(00166)	(.00001)	(.00036)	(.00080)
Whether household holds at least $500 in cash assets	.042	.042	-.124	-3.275	.206	1.808	-2.139
	(.030)	(.131)	(1.864)	(2.851)	(.130)	(.620)	(1.379)
Whether someone in household owns the house	.018	-.012	-4.006**	-3.688	-.087	-.518	1.198
	(.025)	(.108)	(1.539)	(2.355)	(.110)	(.512)	(1.144)
Demographic Characteristics (binary variables)							
Age=19 to 24 and male	.035	.396*	14.969**	-23.784**	.047	.581	-10.966**
	(.065)	(.236)	(3.362)	(5.142)	(.243)	(1.118)	(2.525)
Age=19 to 24 and female	.173**	-1.183**	-4.054	-50.932**	.338	.685	-7.886**
	(.060)	(.229)	(3.252)	(4.974)	(.230)	(1.082)	(2.414)
Age=25 to 50 and female	.178**	-1.041**	-8.984**	-32.378**	-.008	.985	-.157
	(.038)	(.159)	(2.264)	(3.463)	(.166)	(.753)	(1.684)
Age=51 to 64 and female	.305**	-0.972**	-5.502*	-34.613**	.198	4.519	9.685**
	(.047)	(.206)	(2.937)	(4.493)	(.211)	(.977)	(2.188)
Age=51 to 64 and male	.119**	-.443**	3.285	-14.847**	.399*	1.365	4.634**
	(.045)	(.199)	(2.836)	(4.338)	(.201)	(.943)	(2.096)
Age>=65 and female	.399**	-1.295**	-15.350**	-40.309**	.609**	6.174	11.510**
	(.047)	(.207)	(2.939)	(4.496)	(.206)	(.978)	(2.190)
Age>=65 and male	.194**	-.759**	-10.790**	-23.284**	.139	2.495	13.702**
	(.049)	(.210)	(2.988)	(4.571)	(.216)	(.994)	(2.223)
Pregnant or lactating female	.058	.505	4.827	18.342**	-.613	3.661	1.765
	(.102)	(.416)	(5.924)	(9.062)	(.472)	(1.971)	(4.339)
Hispanic	.120**	.370**	-4.053*	-9.241**	.427**	3.954	2.784*
	(.035)	(.149)	(2.123)	(3.247)	(.147)	(. 706)	(1.571)

TABLE D.3 *(continued)*

	Dependent Variable						
Independent Variables	Dietary Behavior Index	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
Non-Hispanic black	.009	-.203	-1.486	-14.354**	-.066	-1.699	-.415
	(.032)	(.141)	(2.012)	(3.078)	(.147)	(.669)	(1.488)
Other racial/ethnic group	.118*	.105	-11.603**	-24.567**	.846**	2.745	-.142
	(.064)	(.255)	(3.626)	(5.547)	(.242)	(1.206)	(2.745)
Midwest	-.123**	.410**	4.992**	2.555	.007	-1.066	-4.239**
	(.037)	(.167)	(2.379)	(3.640)	(.170)	(.791)	(1.762)
South	-.093**	.117	-2.788	-6.174*	.106	-2.517	-0.195
	(.034)	(.150)	(2.132)	(3.262)	(.151)	(.709)	(1.579)
West	-.044	.207	2.614	5.498	.162	-.159	-2.979*
	(.038)	(.166)	(2.356)	(3.604)	(.165)	(.784)	(1.743)
Urban	-.076**	-.049	-1.838	-.618	-.120	-.162	2.224*
	(.029)	(.123)	(1.757)	(2.687)	(.122)	(.584)	(1.296)
Rural	-.142**	.166	-.278	.730	-.482**	-1.772	-1.567
	(.029)	(.126)	(1.789)	(2.737)	(.129)	(.595)	(1.326)
Household Characteristics (binary variables)							
No children	.020	.120	5.010*	4.372	-.059	-.437	-2.758
	(.047)	(.190)	(2.706)	(4.140)	(.195)	(.900)	(1.998)
Single adult with child(ren)	-.093*	.119	.658	3.860	-.105	-1.430	-5.434*
	(.049)	(.221)	(3.152)	(4.822)	(.230)	(1.049)	(2.344)
Multiple (nonmarried) adults with child(ren)	-.017	-.257	.186	-2.956	-. 389**	-3.381	-3.854**
	(.044)	(.175)	(2.495)	(3.816)	(.184)	(.830)	(1.856)
Number in household	.004	.072	.354	-.372	.080	.094	1.495**
	(.013)	(.050)	(.707)	(1.082)	(.050)	(.235)	(.528)
Number of children age 1 to 5	-.009	.090	3.564**	3.947*	-.172*	.379	.256
	(.023)	(.096)	(1.365)	(2.0877)	(.100)	(.454)	(1.009)
High school dropout	.022	.021	-1.857	.335	-.016	-.910	.329
	(. 027)	(.115)	(1.635)	(2.502)	(.118)	(.544)	(1.212)
Attended but did not complete college	.066*	.242	3.933*	6.367*	.194	1.647	.222
	(.034)	(.151)	(2.145)	(3.281)	(.152)	(.713)	(1.602)
College graduate	.099**	.536**	1.730	3.420	.258	3.449	-3.726*
	(.045)	(.206)	(2.934)	(4.487)	(.205)	(.976)	(2.171)
Health-Related Variables (binary variables)							
Self-reported health = excellent	.013	.181	3.459	4.938	-.073	-.0521	-1.068
	(.036)	(.154)	(2.198)	(3.362)	(.157)	(.731)	(1.639)
Self-reported health = very good	.013	.079	1.942	3.445	-.147	-.871	-.445
	(.030)	(.132)	(1.874)	(2.867)	(.134)	(.623)	(1.388)
Self-reported health = fair	-.010	.137	-.682	-1.972	-.227*	-.552	1.211
	(.031)	(.135)	(1.915)	(2.929)	(.137	(.637)	(1.415)
Self-reported health = poor	-.051	-.208	.438	3.813	-.236	- 1.992	3.837*
	(.044)	(.191)	(2.725)	(4.168)	(.194)	(.906)	(2.024)
Ever had diabetes	-.017	.088	-1.758	.556	-.524**	-1.218	-1.121
	(.038)	(.168)	(2.384)	(3.647)	(.174)	(.793)	(1.769)
Ever had high blood pressure	.023	.031	-1.925	-5.965**	.013	-.102	1.162
	(.027)	(.122)	(1.739)	(2.659)	(.124)	(.578)	(1.290)
Ever had heart disease	-.024	.241	.328	-.648	.061	1.158	1.997
	(.035)	(.158)	(2.251)	(3.444)	(.159)	(.749)	(1.667)
Ever had cancer	.040	-.152	.022	-1.528	.114	-.627	-.906
	(.045)	(.197)	(2.809)	(4.297)	(.200)	(.934)	(2.093)

TABLE D.3 *(continued)*

Independent Variables	Dietary Behavior Index	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
	Dependent Variable						
Ever had osteoporosis	.051	.070	-3.509	-3.461	.226	-.189	3.464
	(.057)	(.275)	(3.920)	(5.996)	(.269)	(1.304)	(2.904)
Ever had high cholesterol	.069**	.133	.847	5.368*	.178	.994	-1.171
	(.033)	(.148)	(2.108)	(3.224)	(.147)	(.701)	(1.563)
Ever had a stroke	.087*	-.201	-.840	.217	-.083	-.317	-1.009
	(.051)	(.230)	(3.269)	(5.001)	(.232)	(1.09)	(2.454)
Person exercises frequently	.007	.327**	4.403**	5.830**	-.062	-.124	-.104
	(.025)	(.111)	(1.582)	(2.420)	(.114)	(.526)	(1.175)
Person smokes	-.092**	-.056	.645	-3.624	-.108	-2.907	1.193
	(.025)	(.107)	(1.524)	(2.331)	(.110)	(.507)	(1.132)
On weight-loss diet	.243**	-.165	-6.872**	-3.228	.397**	2.368	-.780
	(.033)	(.147)	(2.087)	(3.193)	(.145)	(.694)	(1.553)
Individual takes vitamin supplements	.003	.044	.428	3.125	-.053	1.098	1.128
	(.023)	(.102)	(1.456)	(2.227)	(.104)	(.484)	(1.078)
Dietary Knowledge and Attitudes							
Diet-disease relation knowledge factor	.017**	.048	1.020**	1.392*	.030	.670	.188
	(.007)	(.034)	(.488)	(.746)	(.035)	(.162)	(.361)
Pyramid servings recommendations knowledge factor	-.005	.023	.485	.782	-.091**	-.148	-.481
	(. 009)	(.045)	(.644)	(.985)	(.046)	(.214)	(.477)
Knowledge of foods' fat/cholesterol content factor	.031	-.359	2.927	.705	-.548*	.384	-0.661
	(.066)	(.322)	(4.580)	(7.006)	(.325)	(1.524)	(3.387)
Nutrition importance factor	.210**	-.061	.108	3.656	.196*	1.394	1.351
	(.023)	(.112)	(1.560)	(2.444)	(.117)	(.532)	(1.195)
Belief in diet-health relationship factor	.024*	.010	-2.266**	-1.230	-.115*	.222	-.087
	(.014)	(.067)	(.956)	(1.463)	(.068)	(.318)	(.707)
Other Variables							
Number of hours per day watched TV	-.025**	.033*	1.076**	1.646**	.010	.031	1.131**
	(.004)	(.020)	(.279)	(.426)	(.020)	(.093)	(.206)
Whether household usually shops for food once a month or less	.005	-.255**	-2.246	-3.683	-.024	-1.698	-2.385**
	(.026)	(.114)	(1.629)	(2.492)	(.117)	(.542)	(1.206)
Whether intake interviews took place in the winter	.042	.067	.620	2.393	-.089	.685	.287
	(.033)	(.146)	(2.074)	(3.173)	(.148)	(.690)	(1.539)
Whether intake interviews took place in the spring	-.007	-.071	.955	2.084	-.048	-.061	.505
	(.029)	(.127)	(1.812)	(2.772)	(.130)	(.603)	(1.349)
Whether intake interviews took place in the fall	-.014	-.083	-.618	-1.504	.032	.696	1.078
	(.029)	(.127)	(1.814)	(2.774)	(.129)	(.603)	(1.348)
Whether intake interviews took place on the 1st through 10th of the month (on average)	-.075**	.121	1.879	5.913**	-.233*	-.212	.106
	(.028)	(.122)	(1.739)	(2.661)	(.128)	(.579)	(1.282)
Whether intake interviews took place on the 21st through 31st of the month (on average)	-.015	-.120	-1.254	-3.276	.140	-.480	1.408
	(.027)	(.116)	(1.648)	(2.520)	(.116)	(.548)	(1.229)

TABLE D.3 *(continued)*

Independent Variables	Dependent Variable						
	Dietary Behavior Index	Servings of Vegetables	Food Energy (Kcal as % of RDA)	Calcium (mg as % of RDA)	Whether Fat Intake <= 30% of Food Energy	Healthy Eating Index	Food Energy from Store-Bought Foods (% of total food energy)
Survey year = 1995	.003	.092	3.573**	6.380**	.084	1.592	-1.652
	(.027)	(.120)	(1.706)	(2.609)	(.122)	(.567)	(1.266)
Survey year = 1996	-.003	.378**	4.147**	2.431	-.023	.763	.695
	(.027)	(.116)	(1.648)	(2.520)	(.119)	(.548)	(1.221)
Sample Size	**1,447**	**2,224**	**2,224**	**2,224**	**2,224**	**2,224**	**2,162**
Mean of Dependent Variable	2.63	3.18	78.07	79.09	.315	58.94	77.63
R-Squared	0.36	.12	0.135	0.16	--	.20	.139

SOURCE: 1994-1996 CSFII.

NOTE: All models estimated using OLS regression except for "Whether Fat Intake <= 30% of Food Energy Model," which was estimated using a logit model. All models also included dummy variables controlling for whether information on asset balances was missing whether, information on participation in a child care feeding program was missing, and whether dietary knowledge and attitude information was missing.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.

APPENDIX E

STANDARD ERRORS FOR THE CHAPTER V TABLES

TABLE E.1

IMPACT OF FOOD STAMP PARTICIPATION ON INTAKE OF FOOD GROUP SERVINGS AND OTHER DIETARY COMPONENTS
(Standard Errors in Parentheses)

Food Group Servings	Preschoolers	School-Age Children	Adults
Grain Products	-0.51*	-0.28	-0.08
	(0.24)	(0.23)	(0.17)
Vegetables	0.22	-0.09	-0.19
	(0.15)	(0.15)	(0.11)
Fruit	-0.02	0.05	-0.02
	(0.19)	(0.13)	(0.08)
Dairy Products	-0.15	0.13	0.04
	(0.11)	(0.09)	(0.06)
Meat and Meat Substitutes			
Red meat	-0.10	-0.10	0.04
	(0.06)	(0.06)	(0.05)
Poultry	0.01	-0.02	0.04
	(0.04)	(0.04)	(0.03)
Fish	-0.03	-0.02	-0.05*
	(0.02)	(0.02)	(0.02)
Eggs	-0.02	0.03	0.01
	(0.02)	(0.02)	(0.01)
Nuts and seeds	0.01	0.00	0.01
	(0.01)	(0.01)	(0.01)
Total	-0.13	-0.12	0.03
	(0.08)	(0.07)	(0.06)
Grams of Discretionary Fat	-1.14	-0.07	-0.07
	(1.90)	(2.00)	(1.53)
Teaspoons of Added Sugar	0.60	-0.39	0.83
	(0.78)	(1.07)	(0.73)
Number of Alcoholic Drinks	--	-0.03	-0.08
		(0.05)	(0.09)
Sample Size	**785**	**926**	**2,224**

SOURCE: 1994-1996 Continuing Survey of Food Intakes by Individuals and Diet and Health Knowledge Survey (the regression-adjusted mean values were calculated using sample weights although the original regressions were unweighted).

NOTE: The estimates contained in this table are based on a set of regressions of nutrient intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean serving levels are based on these regression results, along with the assumption that participants receive the mean level of FSP benefits for their group ($65.01 for preschoolers, $60.88 for school-age children, and $57.86 for adults). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The impact is calculated as the difference between these two regression adjusted means. The levels of statistical significance are based on the significance level of the coefficient on the food stamp benefit variable. The full set of regression results for selected nutrients is shown in Appendix D.

The minimal detectable impact at the 80 percent power level is *2.80 x standard error of the impact estimate* for a significance level (-) of .05 (two-tailed test). In other words, the true impact would have to be this number or larger for us to have a high chance (at least 80%) of finding a statistically significant effect, given our sample and data. We would be less likely to be able to detect a true effect that was smaller than this number. For example, for grain products, the minimal detectable impact level for preschoolers at the 80 power level, and a significance level of .10 is 0.504. Most minimal detectable differences fall in the range of 10 to 20 percent of the mean value of the outcome.

*Significantly different from zero at the .05 level, two-tailed test.
**Significantly different from zero at the .01 level, two-tailed test.

TABLE E.2

IMPACT OF FOOD STAMP PARTICIPATION ON NUTRIENT INTAKE
(Low-Income Individuals)

	Impacts on Nutrient Intake Relative to the RDA (Standard Errors in Parentheses)			Impacts on Percentage Meeting RDA Standard (Standard Errors in Parentheses)[a]		
	Preschoolers	School-Age Children	Adults	Preschoolers	School-Age Children	Adults
Macronutrients						
Food Energy	0.0	-1.1	0.1	4.3	3.0	1.4
	(2.9)	(2.4)	(1.6)	(4.1)	(3.7)	(2.0)
Protein	-10.1	-7.4	-0.1	--	--	1.2
	(10.4)	(6.3)	(2.9)	--	--	(1.6)
Vitamins						
Vitamin A	-20.4	-3.7	-3.4	-5.4*	-0.7	-2.3
	(13.7)	(9.3)	(7.4)	(2.9)	(3.7)	(2.5)
Vitamin C	5.1	8.7	2.7	-2.7	1.3	0.4
	(15.0)	(11.7)	(6.6)	(2.8)	(3.1)	(2.3)
Vitamin E	-3.1	0.4	-3.5	0.4	2.0	-4.7*
	(4.9)	(3.4)	(2.7)	(4.4)	(3.9)	(2.5)
Vitamin B_6	-9.2	1.9	-0.8	-3.0	0.1	0.5
	(5.8)	(4.2)	(2.3)	(3.0)	(3.3)	(2.4)
Vitamin B_{12}	-47.2	-3.5	-18.5	0	-3.1*	0.5
	(45.3)	(50.2)	(28.5)	--	(1.7)	(1.7)
Niacin	-6.2	-2.3	-0.7	0.7	-2.0	-0.5
	(6.1)	(4.6)	(3.0)	(2.7)	(2.5)	(1.7)
Thiamin	-7.8	4.3	1.9	-1.7	-3.1	1.7
	(6.1)	(4.8)	(2.9)	(1.9)	(2.1)	(1.8)
Riboflavin	-7.3	5.4	0.9	0	-1.1	-0.5
	(7.2)	(5.1)	(3.2)	--	(2.1)	(1.9)
Folate	-25.4	17.9**	-3.2	0	-2.5	1.0
	(18.7)	(9.0)	(3.9)	--	(2.4)	(2.2)
Minerals						
Calcium	-3.9	2.1	0.1	2	-0.1	0.6
	(4.2)	(3.2)	(2.5)	(4.0)	(3.4)	(2.4)
Iron	-10.5**	-0.7	-3.0	-2.2	2.3	0.0
	(5.0)	(4.9)	(3.6)	(3.4)	(2.7)	(2.1)
Magnesium	-6.6	0.4	-3.2*	0	1.1	-1.5
	(7.2)	(3.6)	(1.8)	--	(3.2)	(3.4)
Phosphorus	-3.1	-0.7	-1.2	-2.3	1.3	0.4
	(4.1)	(4.0)	(3.1)	(2.4)	(2.4)	(1.8)
Zinc	-2.9	-2.9	1.2	-6.7	-3.1	-0.8
	(3.3)	(3.2)	(2.6)	(4.4)	(2.9)	(2.4)
Sample Size	**785**	**926**	**2,224**	**785**	**926**	**2,224**

SOURCE: 1994-1996 Continuing Survey of Food Intake by Individuals (the regression-adjusted mean values were calculated using sample weights, although the original regressions were unweighted).

TABLE E.2 *(continued)*

NOTE: The estimates contained in this table are based on a set of regressions of nutrient intake on a series of independent variables, including food stamp benefits. The regression-adjusted mean intake levels and mean percentages meeting 70 percent (100 percent) of the RDA among participants are based on these regression results along with the assumption that FS participants receive the mean level of FS benefits for their group ($65.01 for preschoolers, $60.88 for school-age children, and $57.86 for adults). The regression-adjusted means for nonparticipants are based on the assumption that these individuals receive $0 in food stamp benefits. The impact is calculated as the difference between these two regression-adjusted means. The levels of statistical significance are based on the significance level of the coefficient on the food stamp benefit variable. The full set of regression results for selected nutrients is shown in Appendix D.

The minimal detectable impact at the 80 percent power level is *2.12 x standard error of the impact estimate* for a significance level (-) of .10 and *2.80 x standard error of the impact estimate* for a significance level (-) of .05 (two-tailed test). In other words, the true impact would have to be this number or larger for us to have a high chance (at least 80%) of finding a statistically significant effect, given our sample and data. We would be less likely to be able to detect a true effect that was smaller than this number. Most minimal detectable differences fall in the range of 10 to 20 percent of the mean value of the outcome.

[a] We used 100 percent of the RDA as the standard for food energy and used 70 percent of the RDA as the standard for the remaining nutrients.

*Significantly different from zero at the .10 level, two-tailed test.
**Significantly different from zero at the .05 level, two-tailed test.